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EXPLORATIONS IN PATAGONIA.*

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I.

Our President lately recalled the fact that vast areas existed in South America still unknown to geography, which were not only interesting on account of the rich products they may be presumed to contain, but also for the variety, beauty, and charm of their landscapes. This certainly referred, amongst other regions, to certain parts of the Argentine Republic, and particularly to Patagonia.

As a matter of fact, up to quite recent times, the geography of the southern portion of the New World has been in a very backward state. Since the memorable hydrographical expeditions of the *Adventure* and the *Beagle*, supplemented later on by those of the *Nassau* and the *Maine*, we can only remember the Chilian investigations in Chiloe and Guaitecas and on the western coast of Patagonia. With reference to the interior of the latter country south of parallel 40°, the little that was known up to 1870 was derived from Argentine or Chilian surveys of very limited areas, and since the discovery of the Chubut river by the *Beagle* expedition, and the exploration of the river Santa Cruz, in which Charles Darwin took part, the maps of Patagonia have presented no new feature; its fluvial system was taken from the ancient Spanish charts, and of its numerous lakes only some three or four were indicated, and even then their exact position remained undecided.

It was not until 1869-70 that George Chaworth Musters crossed Patagonia from end to end for the first time, in the company of some Tehuelchian Indians, on one of their periodical migrations; but,

* Read in part at the Royal Geographical Society, May 29, 1899. Map, p. 352. A map on a much larger scale will be published in a future number.

unfortunately, owing to the mode of life he had to follow, and the route chosen by the Indians—the easiest and the one most abounding with game, but still the least interesting one—his narrative, although it constitutes a picture full of life and interest, by the description of the customs of his fellow-travellers and of the general aspect of the landscape, contains little of a concrete or new character from a purely geographical standpoint. It may, therefore, be affirmed that the detailed survey of the Patagonian territory first became of importance when the agitation commenced with respect to the boundary question between the Argentine Republic and Chile.

Both countries claimed, as a heritage from Spain, the austral region, and if both parties were in possession of documents, more or less authentic, which support their arguments as to the respective jurisdictions prior to the emancipation from the mother country over the territory in dispute, little or nothing had been done by them to determine its nature. The Argentine Republic considered as belonging to her the territories to the east of the crest of the Andean mountain range, or the "Cordillera Nevada" of the *conquistadores* and the Spanish historians—a formidable barrier and boundary imposed by nature herself; whilst Chile maintained that her territory included Patagonia as far as the Atlantic coast, and proposed to colonize the territory situated east of the Cordillera, which Captain Simpson, of the Chilian navy, had traversed, in 1873, from side to side, following the course of the Aisen river until he saw it descend from the eastern plains. The Argentine Republic possessed settlements in Rio Negro, Chubut, Santa Cruz, and Staten island; whereas Chile had founded Punta Arenas in the Straits of Magellan, but the interior of the country remained an enigma, which commenced to be solved in 1872, when an Argentine naval officer, Mr. Feilberg, ascended for the second time, forty years after Fitzroy, the river Santa Cruz, and proceeded as far as a lake which he believed to be the one discovered by Viedma, in 1782.

It was in 1873, when I made my first excursion to Patagonia, that I visited the Rio Negro. The year following, I returned to the same places, and went as far as Santa Cruz. In 1875 I crossed from Buenos Aires to Lake Nahuel-Huapi and the Andean Cordillera, between parallels 39° 30′ and 42°. In 1876 I visited Chubut, and ascended the river Santa Cruz, recognizing that the lake found by Feilberg was not the one Viedma discovered, and that these lakes, with many others, formed a vast system situated in a longitudinal depression parallel with the Cordillera. In the tract of land between Santa Cruz and the Straits of Magellan, I was able to confirm the fact already announced by the first Spanish navigators and by the hydrographers of the "Beagle," that the Andean Cordillera was traversed by channels which conveyed the salt waters of the Pacific to the Patagonian plains, and that the chain, shown in many maps as separating Otway Water from the Straits of Magellan,

does not exist, the isthmus consisting of an insignificant deposit of loose stones and sand left by the ice, and scarcely raised above sea-level. In 1877, some Chilian officers visited the sources of the river Santa Cruz in the lake. Steinmann shortly afterwards reached the same point, as well as the Argentine travellers, Castillo, Moyano, and Lista. Moyano crossed from Santa Cruz to the Chubut, partly following the route taken by Musters and that of Durnford, who had visited lakes Musters and Colhue in 1877. In 1879 I again returned to the Rio Negro, crossed Patagonia as far as the Cordillera, on parallel 44, and followed the slopes towards the north, again examining lake Nahuel-Huapi, and reaching nearly up to parallel 39°. If, up to that time, the surveying of

EASTERN SLOPE OF THE CORDILLERA OF THE ANDES AT LAST HOPE INLET.

those regions was not exempt from a certain amount of danger, in view of the attitude of the native tribes, this danger disappeared after the defeat inflicted upon them by the Argentine forces. It was at this period that the 1881 treaty was made, by which Argentina and Chile remained separated in Patagonia, to the north of parallel 52°, by the Andean Cordillera; and expeditions continued to explore the latter. The treaty stated that the boundary between the two countries was the Cordillera of the Andes, and that the dividing line was to run along the watershed of the highest crest. But when boundary treaties are not preceded by an adequate survey of the land on which this boundary is to be traced, they always give rise to difficulties when they are being

actually carried into effect. These difficulties soon arose. Which was the line agreed upon? The Argentines maintained that it was the crest of the Cordillera in its watershed; whereas the Chilians advanced the opinion that the boundary agreed upon was the parting of the continental waters, whether that coincided or not with the crest, or was situated outside, and at a distance from, the Cordillera.

Chile sent out explorers, who penetrated the country from the west; and the Argentine Republic did the same. I myself set to work to carry out similar investigations with the conviction that, in the same way as the logical development of a nation is not achieved unless the geography of its territory be known, nothing can be more prejudicial to its interests than such ignorance in discussions relating to its frontiers. From 1882 to 1895, I examined the Andean regions of the Republic, between parallels 23° and 34°; and, in 1896, I returned to Patagonia by the slopes of the Cordillera and the interior thereof, until I reached Lake Buenos Aires, in 46° 30′. In 1897 I visited the Patagonian region situated between the Straits of Magellan and parallel 51°, and examined several of the western fjords as far as Puerto Montt, in latitude 42°. In 1898 I ascended, for the second time, the Santa Cruz river, reaching the same point visited by me the previous year, on parallel 51°, and, along the eastern slopes, I traversed the territory as far as Lake Nahuel-Huapi and Puerto Montt. It is with this material that I purpose giving a sketch of what Patagonia is, under various aspects; the deficiencies of which sketch will, I think, be made good by the photographs I shall show.

II.

Many of the Patagonian landscapes will certainly be surprising. Captain Fitzroy and Charles Darwin were very unfortunate when they explored the river Santa Cruz. The landscapes left a disagreeable impression on them; and this impression subsequently became general with regard to the whole of Patagonia. In my own country I have found considerable difficulty in obtaining a hearing when I have stated that, although the English explorers spoke the truth, and that any one visiting the same spots would receive the same impression as they did, nevertheless, Patagonia did not merit its bad reputation; but, on the contrary, a vast field for human initiative existed there, with a healthy soil capable of supporting a large population.

In comparing the mountains of South America with those of North America, we might say that the Brazilian mountains have a corresponding situation to the Appalachians; that some of the Peruvian, Bolivian, and Argentine ranges have an analogous position to the Rocky Mountains; whilst the Andean Cordillera corresponds to the ranges on the North Pacific coast. The same vast plains, the same great ridges, and almost the same high plateaus, characterize them. The landscapes

of the Mississippi are reproduced on the Paraná; the broken plains and the plateaus of New Mexico and Arizona find their analogy in the Argentine northern plateaus and in the table-lands of Patagonia; whilst the ice-bound plains of Canada find modest companions in the extreme south; and the picturesque fjords and white mountains of Alaska seem to be a copy of the fjords and mountains of Patagonia, or *vice versâ*. The analogy might be carried still further. It is surprising what a similarity exists between the ancient industries of the natives of New Mexico and those of north-west Argentina; and any one who compares the ancient customs and industries of the coast of the Pacific Ocean—at either extremity—will obtain some curious revelations.

MYLODON CAVE NEAR LAST HOPE INLET.

The territorial area of Argentina consists of more than a million square miles, and, in three-quarters of its extent, presents the contrast of the most level plains in the world, with mountains which may be reckoned amongst the highest. With the exception of the rugged nature of the north-west regions, which are prolongations of the mountains of Bolivia, and a few small islands of the ancient Pampean sea—so well described by our associate, Colonel George Earl Church—one passes from the superficies of the said sea to the abrupt wall of the mountain in so striking a manner that the natives call the slopes, the "Costa," thus, perhaps, evoking the lost sea or the great lakes which filled it, and of which traces still exist, and which indubitably existed in the human period.

This spectacle of the mountain abruptly dominating the plain, stops at the height of parallel 34°, and the vast *pampa* is scarcely interrupted at the south by the archaic and paleozoic rocks of the Tandil, the Ventana and the Pampa Central, bounded on the east by the Atlantic, and on the west by the scarcely discernible continuation of the central-northern ridges which divide the plain of a western depression that commences in Bolivia, in lake Titicaca, or further north, and carries the waters of the Eastern Andean region of Argentina to the Atlantic by the river Colorado. This depression is, in its turn, limited on the south by the plateau which separates it from the Rio Negro, and it is this plateau which is generally considered as the northern limit of Patagonia; although, owing to many of its physiographical features, the Patagonian *facies* may be considered as extending as far as the Bolivian plateaus of the Titicaca, agreeing generally with its flora and fauna.

It is difficult to state briefly what ought to be understood by the expression "Patagonian Region" in its general characteristics; and I must, for the present, confine myself to assign its political limits which, on the north, are the Rio Negro; on the south, the Straits of Magellan; and, on the east and west, the ocean. Within its 300,000 square miles, the landscapes offer striking contrasts. To the east, from the sea, are seen coasts with smooth horizontal surfaces, with slight prominences between parallels 44° and 47°, caused by eruptive formations; a coast which is the cliff of the traditional table-land, streaked with grey, yellow and white bands, of dreary aspect, with perpendicular walls, and a scarcity of ports. On the western side, the scenery is utterly different: a number of islands, with abrupt and wooded coasts, fringe the precipitous coast-line of the continent, which is indented by numerous fjords that penetrate to the very heart of the Cordillera and traverse it completely in the 52° of latitude; a coast similar to that of Norway, or, better still, to that of Alaska, with glaciers reaching down to the sea from parallel 44° 30′, and three-quarters of the mountains covered with ice and snow.

Between the two coasts, terraces cut into the elevated plateau, some extensive, others reduced, form the table-lands, separated by depressions (the most extensive, being transversal), generally covered with a layer of pebbles, and, here and there, by lava-streams, between the remains of the ancient range which has nearly disappeared from the centre, which remains are, perhaps, the continuation of the mountains of Central Northern Argentina, and in the west a longitudinal depression that precedes the Andean Cordillera and lies parallel to it. This depression is of a smooth and gently undulating character, of an exclusively erosive and glacial aspect, but evidently of tectonic origin, very beautiful, dotted with numerous lakes. Some of these lakes empty themselves into the monotonous Atlantic rivers; others reach the Pacific in impetuous torrents which cut through the whole mass of the Cordillera. The

hydrographical network is then so rambling, that it is not always possible to fix the exact course of some of its secondary components, which sometimes flow into the Atlantic rivers, and at other times into those of the Pacific, their course often depending on periods of rain or drought, or the shifting of sand or shingle, and also, sometimes in certain springs, on the action of rodents, which are a veritable calamity in Patagonia, but easy to remedy. This phenomenon of a dividing-line of waters flowing into opposite oceans, which partly rise in plains and glens hardly higher than the level of the sea, and which overcome such formidable obstacles as the Andean Cordillera, piercing its crystalline axis and the

CONTINENTAL DIVIDE IN THE GLACIAL DEPOSITS OF RIVER VISCACHAS.

enormous mass of rocks which have accumulated upon this axis, constitutes, in my opinion, a fact which is unique in the world.

It is very possible that, when a careful survey of the Andean Cordillera and its vicinity is made, it will be proved that a great portion of its actual upheaval took place in very modern epochs; and that man, already possessing a culture analogous, to a certain extent, to that of nations which are reputed civilized, witnessed the modification of the physiognomy of the soil of South America. It seems to me incredible that man could have found means of existence at an altitude of 18,000 feet, and yet, at this elevation, on the Puna de Atacama,

human remains have been found, which proves that he did. The gigantic ruins of the Bolivian table-lands suggest that the upheaval of the soil to its present altitude was subsequent to the construction of the buildings, the ruins of which are preserved, as man could not now construct similar works there. I have seen on the Puna de Atacama, in parallel 26°, at an altitude of 14,000 feet, the remains of extensive villages, where it would not now be possible for moderate groups of people to live. It is well known that there are abundant remains of the great pampean mammalia in the clay formations of the Bolivian plateaus; and it is difficult to believe that such animals could have lived at that altitude.

The extreme south participates in this recent upheaval of the Earth's surface, and its orography is intimately connected with this movement, which is still going on, and which is, with erosion, also probably one of the causes of the abnormal water-divide of the continent leaving the crest of the Cordillera in Patagonia, to transfer itself to the plains lying alone on its eastern slopes. Charles Darwin has left us some observations of the utmost value with respect to the upheaval of the Earth's surface in South America; and it is a matter for regret that they have not been continued with similar attention by subsequent observers.

If a careful examination be made of the accounts given by the early navigators who visited the extreme south of America, we shall find that the country, as they saw it, has been modified in several places. It is very possible that some remains of the channel shown in some of the maps, between Admiralty sound and San Sebastian bay, in Tierra del Fuego, existed at that period; that the isthmus which separates Otway Water from Magellan straits, did not then rise above high-water mark; and that several of the streams now flowing into the Pacific from the east of the Cordillera, and even from the Patagonian plains, crossed them to reach the Atlantic:—a mass of facts which ought to attract militant investigators, all the more that the places in which they are to be observed are, more or less, easy of access, compared with other places in the world, of less interest, but which, nevertheless, are much better known.

In the reports of Dr. Otto Nordenskjöld, the Society possesses a general exact picture of the physiognomy of the large island of Tierra del Fuego. This island I have only seen from the sea; and Sir Martin Conway has graphically described the mountainous western portion. My description will commence, then, in the Straits of Magellan. When the coast is observed from the Atlantic, one sees the straight line of the terraces on both sides, and the others of Virgin Cape. Once in the straits to the north, on the low base formed by the coast, the tertiary line stands out, now receding, now advancing; its regular summits broken by small hills, which are so many extinct volcanoes. At the foot of the

plateaus, gorges and low hillocks fill up the ancient extension of sea waters, which, not very long ago, dashed at the foot of the plateau, but now are far away. To the south, in Tierra del Fuego, the same dreary views exist, but minus the volcanoes, the effects of which are only seen, in a very limited area, near the straits; and so one reaches the west, until, to the north, the principal table-land is seen rising towards the west and penetrating towards the north-west, forming a vast circle, which is lost in the distance, snow-capped mountains rising on the horizon. To the south, the grand Fuegian island terminates, after leaving the narrows; and the northern beach continues along the vast sheet of the straits.

The Patagonian tertiary formation ceases there, and with it its characteristic aspect. Steamers anchor in Punta Arenas, in the ancient island, now the Brunswick peninsula. From there, in clear weather, can be seen, to the south, the snow-capped summits of Mounts Sarmiento, Darwin, and Olivaia, in the high ranges which are the continuation of the Chilian Cordillera of the Coast and the Cordillera of the Andes, which are lost to view in Staten island and Cape Horn. Any one who follows the navigation of the straits will not fail to perceive the curious topography of the region and its varying outlines. It has the appearance of recently inundated land, from which the waters are receding after having covered it entirely. More than once, in crossing Patagonia, I have recalled to my mind the appearance of Magellan straits when I found myself in the transversal depressions which cross the country, and I have imagined a cluster of more or less extensive islands, of a general elevation analogous, and of similar type, to that formed, at no very distant date, by Magellan straits and what we might call the Straits of Gallegos.

The islands of this archipelago, formed by upheavals and submergences, connected with the tectonic movements which have formed the present Andean cordillera, and to which movements must be ascribed the fractures which give the austral region such a characteristic aspect, were separated from one another by straits similar to Magellan, which straits disappeared with the general upheaval and the glacial deposits, leaving more or less extensive valleys through which flow the rivers Negro, Chubut, Santa Cruz, Coile, and Gallegos and its affluents, and others having no permanent fluvial currents. It has been said that the interior of Patagonia is formed by a succession of terraces, having an east-to-west direction up to the Cordillera; this does not appear to me to be altogether exact, but it is indubitable that at one time the whole region rose uniformly to a greater height in the west than along the present Atlantic coast. The Saint Gregory cliffs in the straits, in their western part, are more or less of the same elevation as those of the confluence of the Rio Negro and the Limay, in parallel 39°; the same topographical features distinguish these cliffs near the mountains;

and we might assert, even, that their strata are of the same age, as is proved by the fossils which have been found in them. The recent volcanic eruptions extend from parallel 41° up to the straits in the same zone; and the periods of eruption seem to have been almost indentical; the Mount Aymond volcanoes are similar to those of Mount Yagagtu in Rio Negro territory. The uniformity is almost general: the same geology, the same fauna, and the same flora; and it only alters in the north with the remains of the longitudinal ridges which appear to the south of Rio Negro with its granites, porphyries, trachytes, and ancient schists, extending, in more or less imposing masses, as far as the river of port Desire, dividing Patagonia and its table-lands into two parts, north of this parallel. I am of opinion that, in the early days of the tertiary formation, Patagonia was of greater extent than at present; that a part of its territory advanced much further into the Atlantic; and that the bed of the latter, between the present coast-line and the eastern parts of the Falkland islands, was nothing else than a plateau, submerged at a relatively modern epoch, the upheaval of which has again commenced.

The bold, characteristic relief of the Patagonian terraces is intimately connected with the upheavals, and erosions produced by great rivers and lakes, the greater part of which have since disappeared. These terraces are really true lines of level left by these rivers and lakes, which did not all, however, have their origin in the present Cordillera; but some had their origin in the centre of the country, which to-day is almost entirely waterless, and which, it also appears to me, were connected with lands which have now disappeared.

The larger number of the lakes which fed these rivers in the Andean region still exists; but of those of the central region scarcely any remain; the twin lakes Musters and Colhue are rapidly drying up, together with a few insignificant lagoons. Nevertheless, when the territory is crossed, one sees great cavities—empty lakes—and vestiges of their powerful outflows. Their shores present characteristic terraced levels; and in connecting their lines of elevation, one finds that, as I have remarked, the terracing is not generally regular. The present terraces are nothing but the evidences which have been left by ancient lacustrine or fluvial levels; and although the altitude above the sea of the strata of which the general table-land is composed is greater on the west—thus exposing to view others on the western border of the plateau which do not appear in the Atlantic coast—this fact is not of a perfectly absolute uniformity, as, in San Julian on the sea-coast, cretaceous strata are observed, as also in the vicinity of the Cordillera.

The monotonous plateaus generally terminate, as I have stated, in the vicinity of the first mountains, which are parallel with the true Cordillera, and the general character of the Patagonian region completely changes. If you examine the map of South America, you will

see that, to the south, two chains of mountains exist: the Cordillera of the Andes, and the Cordillera of the coast in Chile. It may be said that, from the Atacama desert, the two chains run parallel to each other; at times their spurs seem to become confounded; but the geologists Pissis and Domeiko have pointed out an intermediary valley running between them, throughout their extension, from north to south. In the north, this valley is filled principally by the products of recent volcanoes; it is then contracted, and almost obliterated, by the spurs referred to; but it subsequently widens out to form the very fertile central valley of Chile, gradually descending to the south until it buries itself beneath the Pacific, opening out or contracting itself, as in the

RIVER SANTA CRUZ.

north, and covered with alluvial deposits and ashes even under the coast waters of the Pacific, as far as Tierra del Fuego; a tectonic valley, and perhaps one of the longest in the world. Parallel to this, but situated to the east of the Cordillera, a similar valley is found, the existence of which was suggested by me in 1879, which is more or less continuously contracted or effaced by the same causes, but not completely buried under water, as has happened to the western valley. The Andean Cordillera rises between the two depressions. The Chilian valley penetrates the sea at parallel 42°; but three degrees above, the chief part of its extension, it is occupied by a series of lakes, generally transversal, which seem to fill cavities that coincide with profound ravines in the Cordillera, whereas the Argentine valley only

sinks beneath the sea 10° further south. In this eastern longitudinal valley, the actual lacustrine series fills the space comprised between parallels 38° and 52°, at times interrupted by local tectonic accidents, which took place after its period of formation, or by vulcanism or accumulations of glacial detritus. This general valley forms one of the most interesting, most fertile, and most beautiful zones of South America, owing to the variety of its topographical forms, the geological construction of the enclosing mountains—which breaks the monotonous grey of the Alpine views—the flora with which it is adorned, and the immense glaciers, some of which send crystalline icebergs into the green or blue waters of the lakes. Another Patagonian contrast is the white and blue ice on the black basalts, crenellated peaks, and cliffs of monumental shape reflecting themselves in the waters of the western shores of the lakes, mingled with the leafy garlands formed by the woods, so rich and varied in their flora; whilst to the east, bare of arboreal vegetation and monotonous, rises the precipitous plateau. At a jump, one passes from the elevated flats of the arid volcanic plateaus to green fields and wooded valleys; from stiff and miserable bushes to the handsome fern and fuchsia region.

Setting out from Punta Arenas, towards the north, the woods cover the cretaceous hills, and the road mainly follows the high-water mark, winding between rocks, the erratic remains of the now almost obliterated moraines, and partly traverses beautiful fields. Under the trunks of old trees one meets with deposits of molluscs, the remains of meals of the ancient natives. In this way one arrives at the isthmus between Otway water and the straits; the ground undulates, the woods disappear, and, gradually, erratic boulders become visible everywhere, looking like small isolated hillocks between the cretaceous hills and the distant cliffs of the Saint Gregory plateau and the straits, where salt lakes—vestiges of the very modern upheaval of the region—are to be seen. Immediately to the west is Otway Water; and at the bottom the low hills of King William's land, which precede the "Cordillera Nevada."

The Andine eastern longitudinal depression is partly represented there by the Fitzroy channel, and its vicinity is dominated by the edge of the western tertiary plateau, which rises gradually, cut out on the western shores and ravines by rain and frost; and, to the east, the volcanoes Orejas de Burro, Mount Aymond, and La Picana, from 700 to 1000 feet altitude. I have already remarked that the plateau commands the straits from Virgin cape. Between this and the valley of the river Gallegos, the undulating surface is grassy, sparse in timber, with deep gorges which cross each other, and with volcanic cones which have scattered lava-streams in ancient and recent times. Hundreds of thousands of sheep now pasture upon it, whilst in the deep gorges of the Atlantic coast, gold-seekers continue their researches in the glacial deposits. The Argentine-Chilian frontier line crosses it from

east to west, up to Mount Aymond, deviating from that point up to the intersection of meridian 70° from Greenwich with parallel 52°, at the base of the Picana crater, to follow the parallel to the coast of the western channels. These volcanoes appear as though they did not extend to the west of the longitudinal depression, as I have not seen there, amongst the rocks moved down by the ice, any pieces of lava. An arenaceous conglomerate, covered with erratic boulders of granite and quartzite, separates another glacial depression filled by the Blanca lagoon, which is now gradually disappearing, divided into two sections, the northern limit being the edge of the plateau which continues to the Campana hill, which forms its western extremity. The surface of this

WESTERN ARM OF LAKE ARGENTINO.

is always undulating pasture land, and shows, on the west, small groves of *Fagus pumilio*. To the north and east flow affluents of the river Gallegos, and to the west, rounded hills, dotted with erratic boulders, rise above the plateau.

The northern edge of the table-land overlooks another transverse valley of the continent, an ancient strait, as I have said before, in which the river Gallegos now runs, and at its base several andesitic hills are encountered, which rise up above the valley in the vicinity of the two edges of the plateau, but without attaining the altitude of the latter. The broad valley which extends between Obstruction sound and the Atlantic ocean, an ancient channel filled with glacial detritus, which gives it a characteristic appearance, with extensive lateral

moraines and frontings cut by the great glacial river, the gradual decline of which is shown by the terraces left by its distinct levels.

When the Spanish navigator, Ladrillero, in 1557, entered the channels to the west of the Cordillera, in search of a passage to the Atlantic, he found low-lying lands, and in them a channel more than 45 miles long by 4½ wide, penetrating east-north-east. In 1830 Lieutenant Skyring and Mate Kirke, of the *Beagle*, explored the same regions, and observed a vast expanse of water divided by a low isthmus cut by a river which drained it, the remains of the Ladrillero channel. I say "remains," as I think that the elevation of this isthmus is of very recent date, as indicated by the young trees referred to by Kirke. This sheet of water is now known by the name of Lake Balmaceda; and to the south of this another one of the same size, Lake Pinto, is found, whilst to the east there are other smaller ones, situated between various lines of moraines, more or less destroyed, which separate the waters that, from the northern and southern plateau, flow westward to feed these waters, and, eastward, to form the river Gallegos. This is a characteristic glacial landscape; the boulder clay, which is seen very distinctly in the Blanca lagoon, fills the valley, being displayed in large patches in the same way as is observed in all the other northern valleys. The remains of dividing moraines does not attain in some parts an altitude of 200 feet above sea-level, and abounds in large erratic, perfectly striated rocks.

This river and its affluents flow in a capricious and winding manner, leaving on either side the marshy remains of the ancient fresh-water channel. Imagine the British Channel dry, covered with boulder clay deposits, and a river wandering in its centre to the east, receiving streams from the cliffs of the two coasts, while little hillocks, like those in some parts of London, separate the western streams from little lakes overflowing in that direction to the Atlantic, and you will have the impression of every one of the transverse depressions of Patagonia, the western Atlantic being replaced there by the Pacific channels or the Andean lakes. Lake Balmaceda measures, approximately, 40 square miles, and is partly fed by the waters of other smaller lakes and by streams. Between the most eastern of these lakes and a group of smaller ones which send their waters to the river Gallegos, there is a glacial deposit barely 60 feet wide. In times of flood, these small lakes communicate with each other, and for the time confound the waters flowing to the Pacific with those which go to the Atlantic. It also seems that one of the affluent rivulets of Lake Balmaceda is thrown off from the river Rubens, an affluent of the Gallegos. This river and its affluents have a winding channel, leaving lagoons on either side, the remains of the ancient channel now replaced by the valley.

The present transverse valley takes part in the longitudinal depression

now occupied by the waters of the Pacific, and is bounded on the south by the plateau extending between the Gallegos river and Magellan strait, and on the north by what has been called the Latorre Cordillera, which is not a mountain range, but the continuation of the general table-land itself. Between this and the channels, rise, south of the parallel 52°, the cretaceous ridges, Rotunda and Palladium hills, and to the west, the mountains in front of the principal chain of the Cordillera, here formed by the Sarmiento Cordillera. In Last Hope inlet, which forms a part of these channels, the eastern longitudinal

ANCIENT EASTERN OUTLET OF THE LAKE SAN MARTIN.

valley depression, to which I have referred, terminates under the sea-water.

Dr. Otto Nordenskjöld has given the Society a general description of the part of this depression comprised between the Sierra de los Baguales and the Last Hope inlet, and I will only dwell on this in order to amplify these *data* with a few new observations which complete them. If one penetrates to the extreme west of the Last Hope inlet, this is seen to open out into three branches; the centre one gives entrance to a small lake situated in an opening, which it seems had previously communicated with the Canal de las Montañas, in the extreme north of which flows a river draining another lake, likewise situated in the same depression. The Canal de las Montañas constitutes

the extreme end of a longitudinal valley which separates there the central chain of the Andean Cordillera from the more fragmentary lateral ridges, and to which Mount Balmaceda belongs, and at the eastern base of which the river Serrano empties, bringing to the inlet the waters of the eastern general depression from Mount Stokes glacier, which feeds Lake Dickson. The same river also receives the waters of the central chain, at the base of which is Lake Tyndall, which is bounded on the west by a sheet of ice, truly *Inlandeis*, the remains of that which, in other times, covered the region as far as the present Atlantic coast. All the lakes of the region, even the eastern lagoons, are remains of a single lake which emptied into the river Coile; whilst the present Pacific channels formed another, which also emptied into the Atlantic by way of the river Gallegos, and before the erosion wearing away the rocks in Kirke straits connected the ancient lake with the Pacific, converting the fresh waters into salt.

To-day, between the Patagonian plateau and the Cordillera are found lakes Maravilla (the largest, and the moraines of which are perfectly preserved), Sarmiento (without visible outlet—which must be subterranean—also surrounded by moraines), Paine, Hauthal and Tyndall, Nordenskjöld and Dickson, besides others, the existence of which is known, but which have not been closely inspected. These lakes, formed in tectonic fractures and continued in depressions cut out by the ice, are separated from each other by isolated mountains, of more or less altitude, some having extensive glaciers, as in the case of the interesting Mount Paine, a beautiful massive tertiary granitic laccolithe capped with cretaceous slates, connected by a transversal ridge with the main chain of the Cordillera, and not a volcano as Dr. Nordenskjöld thought; others formed of the same slates, of less height, and with rounder peaks, presenting the form of a whale-back—the name one of them bears—all being mountains which formed the islands of the great exhausted lake, the bed of which, to a great extent, has disappeared, either through the upheaval of the soil or through the glacial detritus which covers all the shores. The landscape is extremely picturesque in this region. To the west, the high mountains of the granitic central chain, with its ice-field and its *nunatacks;* lower down, wooded valleys and the mountain-lakes between the fjords studded with icebergs detached from the ice-fields. Then come the wooded mountains, some with glaciers, of the lateral ridge, formed by metamorphic schists, probably of the lower cretaceous, cut by the deep lakes and by the rivers which drain them. Next we have glacial lakes, occupying the old mouth of the lost fjords, and surrounded with moraines on the east; and, on the north and south cretaceous mountains covered with woods, and hills polished by the lost glacier of the first extension of the glacial period. Then follow the tops of the little transition hills, of the upper cretaceous, which precede the tertiary table-land, and which it may be said limits

the longitudinal depression. The western slates, greatly contorted, assume fantastic forms with their folds, through the deposits of snow between the layers, and rise perpendicularly above the fjords. In one of these intermediary hills, near Last Hope inlet, is situated the cave where the piece of *mylodon* skin was found which has so much attracted the attention of English naturalists. The explanation of the presence there of this extremely interesting piece is difficult; at a time when the animal died, probably the cave was not situated at the same altitude as it is to-day, and the proof of this is the perforation of the rock by pholades. The discovery made by the geologist, Mr. Hauthal, one of my travelling companions, of a bank of *Mytilus edulis*, situated about 7 feet above sea-level, is an evident proof that the upheaval continues.

As I have already said, the transition is violent between the Cordillera and the Patagonian plain; it is most notable in this part of the depression. To the west from the high raised cliff, called Sierra Dorotea, and inclined in the same direction, the tertiary sandstone appears, which extends from the Straits of Magellan, always cut by the transversal depressions, which, further north, surround the base of the Sierras Baguales and Viscachas. This sandstone, in its turn, is covered by the neo-volcanic tuffs, and the glacial gravel deposits which form the so-called Latorre Cordillera, and which, as I have said, is only the characteristic Patagonian plateau, gradually rising from the Atlantic towards the Cordillera, to which, perhaps, at one time, it was united. I have visited the depression and the plateau, and in my excursions I have crossed all the transversal depressions, and have always found the same physiographical character. The tertiary sediments rise gradually from the Atlantic towards the Cordillera; in the vicinity of the latter cretaceous formations appear with tertiary eruptive rocks, the upper ones under the tertiary, the lower exposed at the surface in the centre of the depression, bordering the chains of the Cordillera composed of gneiss, granite, and quartzite, and some sandstones of undetermined age. On the table-land there are more or less extensive patches of volcanic eruptions with their tuffs; the part played by these eruptions in the upheaval of the soil it is not yet possible to determine conclusively, but they have taken place during the whole of the tertiary period up to recent times.

Between the Sierra Dorotea and Punta Alta rises the principal affluent of the Gallegos river, which waters the whole valley, and is occupied by important *estancias*, as is also the case in the neighbourhood of Lakes Maravilla, Sarmiento, and Paine. I have crossed the Patagonian plateau in the vicinity of the Atlantic, and also between Punta Arenas and the Sierra de los Baguales, and, *de visu*, I can state that, although, looking at the cliff from Obstruction sound, it may be considered as a mountain ridge, it has not the slightest analogy with the general idea of a mountain. Its surface, generally flat, with small

undulations produced by glacial erosion, more numerous on the west, covered with gravel, and displaying erratic boulders of great size, extends towards the east, losing itself in the horizon, abounding with guanacos and ostriches, poor in trees and pastures, forming another ancient island between the transversal depressions of the Gallegos and Coile rivers, which also carried to the Atlantic, in other days, the waters of that part of the Cordillera in their broad channel. To-day the enormous accumulation of glacial detritus has modified the hydrographic regimen. At the extremity of the north-west cliff of the plateau rises the principal arm of the river Coile and also the Guillermo rivulet, which flows westward to empty in Lake Maravilla, forming, in this way, another instance of the water-parting of the continent in the plain, on the east of the Cordillera. The landscape is essentially glacial; the various semicircles of the moraines and the winding ridges are seen with perfect clearness, and have accumulated such a quantity of remains, that it must be admitted that the glaciers which produced these accidents had no great oscillations before retiring to where they are now seen in the Cordillera. Large erratic boulders abound as far as 50 miles east of the present snowy mountains; and on the shore of the Coile, near the so-called Mount Palique, a tertiary hillock, covered by the remains of a moraine, I have seen some granitic rocks measuring as much as 400 cubic yards. This so-called Palique mountain is washed on the east by the Viscachas rivulet, one of the most interesting streams of the region, and similar in its characteristics to the river Fenix, to which I shall refer.

The transversal shores of the Sarmiento-Coile's ancient channel is bounded on the north by the Baguales mountains and Viscachas plateau. These mountains were formed by a general upheaval, greater to the west of the plateau, their relief having been increased by modern eruptions, and on the west by cretaceous rocks, among which Hauthal saw layers of diorite, which have accentuated by their upheaval the relief of the mountains. They appear to be separated from the Cordillera by the continuation of the longitudinal depression, which is contracted in that part, and filled with ice from the mass to which Mount Stokes belongs. This glacier separates the basins of the southern lakes from that of Lake Argentine, which feeds the river Santa Cruz, thus sending waters to the Atlantic and waters to the Pacific, by the eastern side of the Cordillera. These waters flow southward to Lake Maravilla by three main streams — the rivers Zamora, Baguales, and Viscachas. The latter, which is the most eastern, and rises in the basaltic plateau, has a course particularly worthy of notice: first it flows to the south-east; then it inclines further east, to again twist violently to the west to the foot of the Palique hill. I have examined these points, and found there one of the most interesting cases of river-capture of Patagonia. In March, 1898, a ledge of shingle and sand, scarcely

3 feet in height, divided the river Viscachas from other channels, then dry, which in the rainy season flowed to the Atlantic; and the natives of the place assured me that at certain periods, when it was in flood after the melting of the snows, the waters flow indiscriminately towards both sides. To-day the waters are diminishing on the east of Patagonia; for some years past rains have been less frequent, and this diminution explains certain phenomena produced there in their distribution.

The Gallegos-Coile plateau turns to the east, diminishing in elevation, eroded by glacial action into cavities, having fresh and salt water ponds or pools, the remaining vestiges left by the Atlantic at the time of the last upheavel of the table-land, until it contracts to the transverse

ANCIENT EASTERN OUTLET OF LAKE BELGRANO.

valley through which the principal affluent of the Coile river runs. If this is crossed and traversed to the north, ascending and descending the undulations covered with glacial mud and with great erratic blocks, and a grassy country which will soon pasture thousands of sheep, one penetrates into the broken ground of the east of Sierra Viscachas between lava-streams of the most picturesque aspect. This is one of the points of Patagonia where the layer of glacial gravel which covers it is most visible. It is seen that, in certain places, the horizontal character of its layers has undergone modifications, and I have examined places in which the gravel layers may be said to be almost vertical, which is only explicable by very recent subsidence or faults. I crossed the plateau from the middle of the Santa Cruz valley to the west, and took the opportunity

to examine its terraces and the isolated depressions of ancient levels, and I think I am safe in asserting, supported by observations made at other points, that some of the depressions of the plateau, and therefore some of the elevations of its borders, are caused by local subsidences, such as occurred in the Yagnagoo plain in the territory of Rio Negro. The St. Joseph bay and New Bay, on the east coast, must have the same origin. Some low hills which are seen on the plateau are entirely composed of beds of stratified rounded gravel, and appear to be the remains of a general layer which has now almost disappeared.

As always happens in Patagonia, the region is more broken to the west than to the east of the plateau; deep gorges, more or less wide, contain rivulets, the remains of the rivers which in former times fed the great Coile drainage system, which river has not a continuous course all the year round.

From the open plateau (2500 feet) one overlooks the extensive valley of the river Santa Cruz, which is deeper than that of the river Gallegos and that of the Coile, being more stony and sterile. I ascended the river Santa Cruz in 1877 and 1898, and I can appreciate the labours of Fitzroy and Darwin when they tried unsuccessfully, to reach its sources. Undoubtedly the great river will be easily navigable by steamers when its channel is once known, its current not being extraordinary, seeing that it was always overcome with a small 9-knot steam-launch during my last ascent.

This is another of the transverse depressions of the continent, opened in tertiary layers, always the same. Only here the basaltic lavas cover the plateau in a great part of its western third, and upon it the craters which produced them stand out. The tertiary cliffs of this valley, from the Atlantic to Lake Argentino, have furnished the remains of very interesting fauna peculiar to Patagonia, upon which I cannot now enlarge.

The valley of the Santa Cruz has also been occupied by ice, and is covered with its detritus. To the east of Lake Argentino, where it rises, one sees on the cliff which overlooks the present river, 150 feet above it, erratic boulders of 600 cubic yards, which have been left by the glacier that formerly covered the lake, the moraines of which limit it.

Lake Argentino is more extensive than Lake Maravilla, partaking of the tectonic and glacial lakes. It extends 60 miles to the west; and the fjords of its extreme west divide into three arms, which receive the waters of large glaciers from Mount Stokes up to the vicinity of Lake Viedma. An important river flows into the end of the north fjord, with clear waters—a sure sign that it proceeds from another great lake still unknown. The western end is closed by the main chain of the Cordillera with its glaciers, which cross to the Pacific fjords of Peel inlet and St. Andrew's sound, and one can distinguish peaks

more than 10,000 feet, as Mount Agassiz (10,597 feet). The lacustrine fjords correspond to the western channels, and communicate with those of the south by the glacier of Mount Stokes by Lake Dickson. Undoubtedly Lake Argentino was more extensive formerly. Mount Buenos Aires and Mount Frias were, in very recent times, islands in the southern part of the lake. To-day the waters are rapidly retiring; a large expanse of the southern shore, which was under water when I saw it in 1877, was dry in 1898. The lands left by the retiring waters are very fertile, and the last time I visited the spot several thousand head of cattle were grazing, having been brought there by two

MOUTH OF THE RIVER LAS HERAS, IN THE CALEN INLET.

English cattle-raisers. This is the first herd that has been raised in such distant regions.

The river Leona drains into the eastern extremity of Lake Argentino, to which it carries the waters of Lake Viedma. This river has a stronger current than the Santa Cruz, between upper cretaceous cliffs, crowned by fossiliferous tertiary caps, which are also observable at the south of the former lake, in which abundant saurian remains have been found. The cretaceous marine formation is observed to the west, at the base of Hobler Hill and Castle Hill, mountains named by Fitzroy, who saw them in the distance. I ascended Leona river in the same steam-launch which had been up the Santa Cruz, and I believe that this river would be easily

navigable when once it had been surveyed. The cliffs, completely denuded in the vicinity of Lake Viedma, are composed of clays, sands, and volcanic tuffs, contain numerous tertiary mammal remains, which await the collector. The gravel cap which covers them did not seem to me so thick as it is further south, and perhaps may have been swept away more easily, as the ravines are at first more frequently produced, perhaps, by neighbouring volcanic eruptions.

Lake Viedma (828 feet) is larger than Lake Argentino, and of a more regular shape in the points examined by my assistants, although it would not be surprising if it had fjords similar to the latter. A vast glacier reaches to the water, and, in clear weather, I have seen it descending from the west like an immense ice-field, from the crest of the central chain, 10,000 feet high, which the ice covers up to its western slope in Eyre sound. To the south and north of this other narrower glaciers are seen in the extremity of the fjord-like bays.

This lake also occupies a tectonic depression, which stretched to the Atlantic, and has had a much greater extension than Lake Argentino, which it still exceeds in extent. At its eastern extremity an extensive ancient arm is seen, which continues up to the narrower valley of the Shehuen river, which empties into the Chico river before it reaches the bay of Santa Cruz. Various dry streams, which were the affluents of this river, were probably the last remains of the northern drainage before it was all effected by the Leona river—a similar instance to that of the river Coile. When I visited this lake in 1877, there were some lagoons which were dry in 1898. The plateau between the river Santa Cruz and the Coile is more broken than that south of the former, and, following the north of the river, one climbs up this plateau, which is covered with basalt, underneath which appear cretaceous sandstones with horizontal folds — a continuation of those of the south. One then descends by depressions through which runs the present river Shehuen, that rises at the base of the same western plateau, the pedestal of the Pana volcano. Again climbing an isolated portion of the plateau, one descends into the true valley of the Shehuen, another depression corresponding to Lake San Martin, which is nothing but the fjord of a large ancient lake. When, in 1877, I followed this valley to descend to the lake, the stream, dry to-day, was partly filled with water. When it has any water now, through snow melting on the lateral plateaus, it runs eastward a little way; but it now seems that it does not reach the river Shehuen, the greater part going westward to the Tar lagoon, which empties into Lake San Martin—another phenomenon of capture, perhaps more interesting than that of the Viscachas, which changes the water-parting of a continent. The Tar lagoon is a remnant of the ancient extension of Lake San Martin, which goes on disappearing, and is found in a plain between the moraines left by the old glacier. Judging by Viedma's account, at the close of the last century a drainage-basin

existed to the east, as the natives stated that the Shehuen (or Chalia) river proceeded from a lake. The Kochait mountain—a porphyry boss, the layers which covered it having completely disappeared—gives a picturesque aspect to the scene, which is varied to the west, monotonous to the east. Through beautiful fields, the bed of ancient lagoons, like Tar, dry to-day, surrounded by moraines, and then through a succession of lines of these,—one arrives at Lake San Martin, the eastern part of which is much smaller than that of Lakes Viedma and Argentino, but the fjords thereof seem to be longer. On the south and east it is enclosed by glaciers between high mountains, but on the north it was impossible to reach its end, owing to the storms which overtook us during the ex-

RAPID IN THE RIVER LAS HERAS.

pedition, which also prevented our examining another arm situated on the east of the principal longitudinal depression. It drains into the Pacific by a river flowing from the end of the southern arm. This river is 150 yards wide, and, after crossing a little lake and forming small waterfalls, runs in a northern direction to Calen inlet, thus forming the river Toro, which flows into the south-eastern arm of the inlet. The great river which the Argentine boat *Golondrina* examined in 1897, and which empties in Eyre sound, descending by a longitudinal depression between the mountains of the central chain, seems to come from a yet unsurveyed lake.

The lake is very picturesque. Its slopes, polished by the ice, partly covered with *Fagus* and *Drimys* woods, and quantities of

Libocedrus of considerable size are seen, and can be profitably exploited when these regions are inhabited, which will be soon, in view of the interest of the Argentine Government in it. Its altitude above the sea is 690 feet, and soundings of 1000 feet have not reached the bottom. When I made my last journey, I followed towards the north, climbing the plateau covered with basaltic lava, and in which craters are very frequent. To the west the lava-streams hide the cretaceous caps, but characteristic fossils are found in its slopes. The centre is a vast lava-field, relatively flat, traversed by streams which generally issue from small lakes, and which empty to the south into an extensive lake enclosed by lava-streams, without any known outlet, called Lake Cardiel, but the ancient channel of which to Rio Chico still exists. Another stream empties to the north into Lake Quiroga, which occupies another volcanic depression of the tableland, also without present outlet, and north of that lake another larger one has its outlet to the river Chico. According to the natives, great salt lakes exist on this plateau. The Andine longitudinal depression continues always to the west, formed here, in part, by the eastern fjord of Lake San Martin. The neo-volcanic lava-streams have formed a ridge between the river Fosiles, which flows into Lake San Martin, and the river Carbon, which flows northwards as an affluent of the Mayer river. The cretaceous rock is denuded in the steep gorges; and more or less important coal-seams are seen in them.

The river Mayer constitutes another instance of the continental water-parting to the east of the Cordillera. Its eastern affluents and the waters forming the river Chico of Santa Cruz, rise in a depression, the remains of an ancient lake, of which two small lagoons are left as vestiges; the outlet thereof on the east is still visible, as are also the distinct levels left by its retiring waters, after stationary periods. I have followed the river until I saw it, voluminous and torrential, enter the first mountain of the Cordillera, but it was impossible for me to see whether it empties into the northern arm of Lake San Martin or runs straight to the west of the central chain towards some of the fjords, visited by the *Golondrina;* but recently it has been explored by my assistants, who discovered that the river empties into the lake San Martin.

The upper basin of the river Mayer is found at a much greater altitude than that of the lakes already named; the interior longitudinal Andine depression must be found more to the west, so that the plateau between the San Martin and it corresponds to a similar topographical type to the Baguales and Vischacas Sierras. The river Chico rises in the plateau near Lake Quiroga, between the lava-streams, at 4070 feet, and bends eastward when it has once reached by a deep ravine an ancient lake, now dry, where, in the same plain, it increases its waters and sends others to the west by an affluent of the river Mayer. The bed of this lake is situated at 1640 feet, and occupied by two small

lagoons, the former communication of which towards the east is perfectly distinct. A little more to the north of the point at which the waters of this basin unite with those from the small glaciers of the adjacent mountains, to form the river Mayer, discovered by Mr. Hatcher in 1897, there falls into it a torrent from the north (1300 feet) which brings it the waters of a series of lakes situated between a ridge which dominates on the west the basin referred to, and which continues to the north up to Lake Belgrano, cut by Lake Burmeister (2740 feet); this lake, in its turn, drains through the Robles stream into the river Belgrano, affluent of the river Chico. The ridge corresponds to that which extends from Lake San Martin between Fosiles river

MARBLE ISLANDS AT THE LAKE BUENOS AIRES.

and the eastern fjord of the same lake. Perhaps the depression where Lakes Nansen and Azara are found corresponds with that fjord. These lakes receive the waters of the beautiful Belgrano lake, which, in its turn, receives those of Lake Volcan, which is close to it. Lake Belgrano, situated at the base of the eastern ridge, emptied, in modern times, to the east, towards the Atlantic, and had a greater extension than is observed in the series of magnificent terraces which are seen in this direction overlooking the river Belgrano, which winds in the valley, to unite with the river Chico. The Tehuelches Indians, when Viedma made his voyage to the lake that bears his name, told him that the Rio Chico flowed from a lake in the Cordillera. Was this lake the Belgrano, or the smaller Lake Bermeister (2740 feet)? I cannot say now. The wide valley of the Rio Chico, the immense quantity of glacial

detritus it contains, and the presence of great erratic boulders, weighing some dozens of tons, which I have seen at its mouth in the bay of Santa Cruz, demonstrate, without leaving any room for doubt, the existence of a great lake in the latter part of the glacial period, of which the present Lakes Volcan, Belgrano, Nansen, and Azara formed a part, which said lake diminished as soon as communication to the south was opened with the present river Mayer. Lake Volcan is situated at 2560 feet, the Belgrano 2495 feet, and the Azara 2395 feet. The latter enters, on the west, a mountain with glaciers, and drains through a violent stream into Lake Nansen (2296 feet), the western arm of which turns more to the west than the others to the main chain, from the glaciers of which it obtains its waters. Here one observes that the mountains diminish in height towards the south, and are probably cut lower down by the waters of the river Mayer, to which the waters of Lake Nansen arrive through a series of rapids. During the examination I made in 1897 in Calen inlet, I found two rivers which drained into the eastern extremities of its two channels, but neither of them had a flow of waters comparable to what I had seen in the river Mayer. Besides, the Rio Coligue, according to a companion, Mr. Lange, who partly ascended it, appears to rise in the mountains, and does not cross the main chain. I have not found in this river Coligue, any pebbles of neovolcanic origin which correspond to the formations on the east of the central chain composed of granite, porphyry, and quartzite; nevertheless, I saw some huemules (*Cervus chilensis*), which indicates the existence of a pass low down between the east and west of the Cordillera, or else a river which traverses it in the vicinity.

The Indians inhabiting the Pacific channels south of Calen inlet hunt the huemul in some valleys at the end of the numerous fjords, which is a proof that low gaps were to be found in the main chain of that part of the Cordillera, or that rivers intersected it.

The huemul is only found to the west of the Cordillera when river-beds or low passes exist, and it is an error to consider it as peculiar to the Chilian fauna. It principally exists in the western intermediary zone, between the table-land and the first rocky hills, it having even been found in the hills in the vicinity of Port Desire on the Atlantic coast.

If one follows the course of the river Belgrano towards the north, one leaves to the east the Patagonian plateau with its raised borders covered with basaltic lavas, and which attains its greatest height in the Mount Belgrano (6560 feet). Short streams rise at the foot of this eminence, and lose themselves in the lagoons between the lavas or in the centre of the country, such as the Olnie, which becomes extinct in an ancient lake-depression some distance to the west of the main road used by the natives in the very lowest part, where a temporary lagoon still exists. The small gap which separates the waters of the Belgrano on the west from the edge of the raised plateau measures 4920 feet, and, crossing to

the other side, there is another stream descending rapidly towards the north to a lacustrine depression, which, starting in a north-north-west direction, then twists to the west. This depression is the deepest that can be found in Patagonia north of the Lake Maravilla, and is principally occupied by Lake Pueyrredon. The eastern part of the plateau north of Mount Belgrano rapidly decreases in height, and the continental water-parting is situated a good distance to the east. The saline lake, nearly dry to-day, which exists there has an altitude of only 345 feet above sea-level, and is the remains of an ancient, more extensive lake; for Lake Posadas, separated from the said lagoon by a glacial drift, measures 400 feet, whilst Lake Pueyrredon, into which it flows, is scarcely 295 feet above sea-level. I have crossed the region some tens of miles to the east, and my attention was directed to the deep and extensive depression in which runs the intermittent stream, called Gio, and it would not be surprising if it corresponded to a very inferior level, and that this may be less than 330 feet above the sea. Unfortunately, when I was there I had not sufficient time to observe them. It cannot be said to-day whither the cavity of the saline lake extends, descending towards the centre of the valley, connecting itself with the actual depression of the river Gio; but, undoubtedly, it forms a part of the same transversal depression which stretches to the Atlantic to the south of Port Desire, and similar to those already mentioned. The southern cliff of the plateau falls almost vertically about 1600 feet down to the depression, whilst on the north it gently rises up to an isolated porphyritic mountain, which is visible from a long distance — Mount Colorado (4600 feet), at the base of which lies the Gio lagoon (1000 feet), fed by an important stream which runs from the west, and then, after descending, from the north, and rising at an altitude of 4625 feet.

The waters of Lake Gio lose themselves in the vicinity of its outlet and in the low plain which extends to the east, and to the east of the saline lake are other smaller lagoons and pools, whose waters do not reach the plain where it is crossed by the general road to the north. Lake Pueyrredon, an ancient tributary of the Atlantic, now empties itself into the river Las Heras by the west, after receiving the waters of Lake Brown, situated slightly more to the west of its centre. A little to the south of Lake Brown a river rises which flows west, and receives its waters from glaciers which also give rise to the river Lacteo, an affluent of Lake Belgrano, and to the west of Lake Brown there are other lakes still unsurveyed.

My assistants, overtaken by the snow, could not reach last year the end of Lake Pueyrredon, nor see, consequently, its outlet; but I have just received news from them, telling me that it empties by a short river into the river Las Heras, an important torrential river, as great or even more voluminous than the river Palena, situated more to the north. During my examination of Calen inlet, I discovered in the north-eastern

arm a river of great volume and depth, descending from the north, but with such a strong current that it was impossible to row against it, and undoubtedly this river is the outlet of the network of lakes situated to the north of Lake Belgrano, and to the east of the main chain of the Cordillera. I do not think this drainage is effected by any unknown river which may empty into one of the bays—Boca de Canales, Jesuit inlet, or Kelly bay. Another important river falls into the northern arm of the Calen inlet, and an enormous glacier is seen there which extends a great distance in this direction; whilst from the west, fed by great glaciers of the eastern slope of the main chain of the Cordillera, an affluent reaches the great river Las Heras, which is the outlet of Lakes Buenos Aires, Soler, the river Tamango, Lake Pueyrredon, etc. The river Tamango has its source in the immediate vicinities of that of the principal affluent of Lake Gio, and flows to the river Las Heras through another transverse depression, towards the west, a short distance north of Lake Pueyrredon.

The gorge of the affluent of the Gio, passing an opening in the plateau (4625 metres), continues towards the north by that of the river Jeinemeni, which, after receiving an affluent rising in a small lake at 2395 feet, empties into Lake Buenos Aires, the largest in Patagonia. Almost parallel with this river runs the one called De los Antiguos, owing to the native remains which are found there, and which correspond to races which no longer live in Patagonia, as I have ascertained after examination of some of their remains. The region between Rio Gio and Lake Buenos Aires is the most dreary that I know in Patagonia, and also the most sterile; it is covered with large lava-deposits from craters which are scattered over the fragmentary elevated plateau. The affluents of the river Desire, which I have crossed, have their sources there. There is nothing more desolate than this landscape, despite the vivid colouring imparted by the tertiary caps burnt by lava, rich in vertebrate remains, and overthrown from their primitive position by the subsidences which a central longitudinal depression has produced, and which follows the route bordered on the east and west by high plateaux capped with basalt. The contrast between the landscape at the foot of pre-Andine mountains and that of the main road across the table-land is worthy of remark. To the west, bubbling, crystalline streams run between the rocks and the forest, making the passage difficult,—the swamps and the abrupt mountains; to the east, a despairing monotony, always the black basalt line, the small bushes and shrubs—when there are any—and the glittering of broken pieces of obsidian which the gravel frequently contains; bare white and yellow cliffs, black wall, or white beds of dried-up lagoons, and here and there a large erratic boulder where the guanaco is hunted. The sole distraction for the traveller in those uninhabited regions are the ostriches and the guanacos. The Olnie rivulet waters the ancient district of the Tehuelches—"Olnie

aiken" = "where there is grease," a favourite hunting-ground, the reputation of which has been handed down by tradition. The natives say that there was much more water there previously; that one of its largest lagoons, dry to-day, was always filled; and that they could camp in any part of the wide lost valley, which is not the case to-day.

This route, between Lake Belgrano and Lake Buenos Aires, is interesting because it demonstrates the ancient distribution of waters in Patagonia and their subsidence. The same number of terraces can generally be counted from the main surface of the plateau: five important ones 165 feet in height more or less; and four varying from 65 feet to 20 feet, as though the causes which brought about the disappearance of the great lost lakes and rivers had been produced contemporaneously. Likewise this part, better than any other, confirms the opinion, already generally accepted, that Patagonia was covered by an extensive ice-cap, at least as far as the present coasts. The great granitic and quartziferous erratic boulders which proceed from the main chain of the Cordillera prove this, and when once the ice disappeared, the climatic conditions permitted the permanent existence of great rivers and lakes which eroded the surface, which was gradually uplifted. It is indubitable that a great portion of the lavas which are seen on the plateau to-day were deposited prior to the glacial period, but it is also certain that the eruptions have continued up to relatively very recent times, as, in some points, not the slightest vestige of erosion can be noticed on its surface, whilst at others it is polished and striated by the ice.

(*To be continued.*)

ROAD-MAKING AND SURVEYING IN BRITISH EAST AFRICA.*

By Captain G. E. SMITH, R.E.

On May 6, 1895, I received orders to proceed forthwith to Zanzibar, to assist the late Captain B. L. Sclater, R.E., in the completion of a road from Mombasa to the shores of the Victoria Nyanza, in order to improve the communications between Uganda and the coast. It was to be a continuation of the "Mackinnon road," which had previously been made by Mr. Wilson under the Imperial British East Africa Company as far as Kibwezi, a distance of 180 miles from Mombasa, and was to be of the simplest kind, unmetalled, and, in fact, the roughest track along which a bullock-cart would go. Captain Sclater, who had previously had two years' experience of rough road-making in Nyasaland (British Central Africa), remained in England to collect the necessary stores for the expedition, while I went out in advance to organize the caravan.

On June 2, 1895, I reached Zanzibar, where I found more than usual

* Read at the Royal Geographical Society, June 26, 1899. Map, p. 352.

difficulty in getting porters, as several large caravans were on the point of starting. It was not until the middle of July that we could collect one hundred men, sufficient for my first start. Captain Sclater, who had arrived at Mombasa in June, remained at the coast to organize other caravans, the last of which did not leave until October, when our caravan became approximately as follows:—

Europeans: in command, the late Captain B. L. Sclater, R.E.; second, Lieut. G. E. Smith, R.E.; assistants, four non-commissioned officers R.E. Indian coolies from Karachi, 100 Swahilis, 100 Askaris, 200 porters. Zulus, 6 bullock-drivers. Up-country natives, from 300 to 500.

We took with us twenty bullock-carts, and had considerable numbers of oxen, donkeys, cows, calves, sheep, goats, etc., besides seven ponies for our own use. The bullock-carts we employed were built at the Royal Arsenal, Woolwich, with two wheels and a pole. They were light and handy, and were usually drawn by three yoke of oxen. Their wheels were so well made that after two years' hard wear we had not broken a single one. They would carry about 1500 lbs.

On July 17, 1895, I started from the coast with our first caravan, with the object of forming a depôt and beginning the road, whilst Captain Sclater from the coast was to organize fresh caravans and start them off up country. Until October I was in advance, prospecting and beginning the road; afterwards Captain Sclater was usually on ahead, and I was finishing up the work behind. It was seldom that our men were all together; indeed, usually we had several camps, each with a white man in charge of it, working at various sections of the road or at the bridges that we built. I have not space to describe such arrangements in detail, nor would a description of all our marches and countermarches be of interest to any one save myself. Briefly I may remark that in two years I shifted camp about three hundred and twenty times, and marched some 5000 miles, which earned me the Swahili sobriquet of "Bwana Kongoni," or hartebeast, because they said I ran about so much.

The late Captain Sclater was anxious, if possible, to make a good map of the country, and the map-making fell to my lot. For the most part I did it in my spare time, taking a day or two, when I could get away from the supervision of the road, for ascending suitable peaks to obtain my trigonometrical observations, whilst my plane-table work or detail was put in as occasion served on the line of march. I had the very great advantage of going several times over most of the country, so that I could work in my detail gradually, first getting in the more conspicuous hills, and afterwards filling in the minor features. This allowed me to get much more accurate results than if I had had to work in everything as I went along the first time, and gave the opportunity of thoroughly testing my work and making corrections where necessary. The Swahilis, who seldom lose the chance of inventing a nickname, also

called me "Bwana Panda Mlima," or "the hill-climber," from the number of hills which we ascended for trigonometrical work.

For the first 180 miles, that is, as far as Kibwezi, the road runs through an uninteresting country, covered with dense thorn scrub and badly supplied with water, the march through the Taru desert being the worst in that respect. Fortunately for us, Mr. Wilson had already made this section of the road; and now the traveller is still more fortunate in being able to pass through this inhospitable country in the train. The land rises sharply in the first 20 miles to a height of nearly 1000 feet, and afterwards more gradually to Kibwezi, which is about 3000 feet above the sea. At Kibwezi our work began with a stiff bit of jungle-cutting over a very rough bit of lava, a couple of miles of graded road over the southern spurs of the Mbinzau hills, and a few miles of bush-cutting, which brought us fairly out on to the Kiboko plains. Up to this point the country is unsuited to cattle, and before the railway reached Kibwezi, many were lost in running transport through this section. The tsetse fly is found at various places, especially near Kibwezi, but I think most of the loss was due to the poor quality and scarcity of the grass and the difficulty of finding sufficient water.

Once the Kiboko plains are reached the country becomes much easier. For our purposes no work was required on the open grass country, with the exception of making a few "drifts" or fords over the rivers to be crossed, which, as it happened, were met at suitable distances for camping. After driving a caravan of carts three or four times across these plains the trail became well marked, and, except in very heavy rain, was good going. Game was abundant, large herds of zebra, hartebeast, wildebeast, and various species of antelope being met with. From one little hill I saw 3000 head of all sorts, including rhinoceros and giraffe.

A good deal has been written of late with regard to preserving the big game of Africa by people who forget that there is another side to the question. Whilst I was in the country where rhinoceros were most common, I lost one man killed and one badly wounded, who had not in either case attacked the rhinoceros. Whilst quietly marching through thick bush, I have had rhinoceros charge suddenly out of it three times. Similar experiences often occurred to other members of the expedition. One of them was knocked down by the shoulder of the animal charging down a narrow path. More than once, when crossing the open plains, I have fired bullets wide of a rhinoceros to drive him off from our track, and have been obliged in the end to kill him because I was not prepared to take the risk of his charging my caravan. A rhinoceros is a thick-skinned animal, and will not take a hint. The elephant is sometimes dangerous without being attacked; but any traveller who has seen the havoc caused by a herd of elephants in a native plantation will understand the joy of the natives when they are killed.

About 50 miles beyond Kibwezi the road reaches Muani, where we

built our first depôt. It is at the foot of the Ukamba hills, about 4600 feet above the sea, and near a good stream. The Wakamba were soon persuaded to bring in food, and we started a thriving trade. I may remind my audience that money in that country was non-existent, unless the various kinds of trade goods, such as calico, beads, brass wire, iron wire, etc., may be called money. Trade is by no means simple. The demand varies from place to place and from time to time, and therefore trade goods have to be designed to satisfy varying needs. Considerable difficulty may be caused if the traveller has not the right sort of calico, of which there were about ten kinds, or of beads, of which we carried nine kinds, or of the other trade goods. And the question is further complicated by the fact that each commodity of trade has an enhanced value for every mile's journey from the coast. When I add that for months after our final start we were unable to get any loads forwarded to us from the coast, owing to the insurrection of Mbaruk and other causes, some of the difficulties of barter and transport may be understood.

Muani may be said to be the beginning of the healthy country, beyond which fever is practically unknown till Kavirondo is reached. The air is cool and bracing, and extraordinarily clear. The sun does not feel excessively hot, and the nights are pleasantly cold.

After 12 miles more of easy work the country rises sharply to the Athi plains. A height of nearly 1000 feet has to be climbed in the next march, making the altitude above the sea over 6000 feet. The road hereabouts was troublesome to locate, as there were so many alternative routes, and I had to examine a good deal of country before coming to a conclusion. In this section we made a graded road, which entailed much earth-work. For the style of unmetalled road we were making, we used, in climbing hills, to endeavour not to exceed a gradient of 1 : 20, or about 3°; but we did not hesitate to put in a bit of 1 : 15, or even steeper, if we saved much work or distance thereby. A new-comer seldom realizes that for a bullock-cart, especially if the drivers are unskilled, a sharp turn on a gradient is much the worst fault in a road. Bullocks must have a straight pull, and you must allow sufficient width at the turns for a caravan to double-team their carts in going up steep or long hills.

A hundred yards or more of 1 : 8 gradient is less objectionable than a couple of sharp turns. If South African waggons are to be used, much easier curves are necessary, unless, of course, they are fully compensated. We saved some work by making the grades for a cart going down country steeper than for one going inland; for the latter is, as a rule, the heavier laden. When we were laying out the road in hilly country, we were careful to grade it well. We had to do a good deal of earth-work in such cases, and should it ever be advisable to improve the road, all the work we did would help; whereas if a road is badly

located, an entirely new road would have to be laid out in order to improve it.

By the end of 1895 we had completed the road to the Athi plains, and in another month it was open as far as Kikuyu. The Athi plains required but little work beyond drifting the rivers, when once the best route across them was decided on. We did not pass through Machako's, the capital of Ukamba, but left it one march to the right. Mr. Ainsworth, the sub-commissioner, has since connected it to the Sclater road by a branch road.

Kikuyu became our headquarters in the early months of 1896, and remained during the rest of our expedition the advanced base from which we drew our supplies for many months. It is a delightful country, from 6500 to 8000 feet above the sea, with a pleasant healthy climate, and with plentiful supplies of food. It is well watered, and has a rich soil. Originally the whole country was forest. The Wakikuyu cleared the middle of the forest for their plantations and villages, and left a thick belt to protect them from their dreaded enemy, the Masai. Timber is still plentiful, but, owing to the more peaceful times which have been established under British rule, they are now rapidly cutting down the forest that remains, as they prefer the newly cleared land for their plantations. The Kikuyu country lies along a line of heights running in a north and south direction, and inhabited chiefly on the eastern side, which slopes gently to the basin of the Athi river and the headwaters of the Tana. To the west the land drops steeply, a fall of 2000 feet, to the Great Rift valley, which extends as a trough-shaped depression north and south for several hundred miles. It has a separate water-system of lakes or marshes with no outlet, fed by rivers of no great length rising in the high mountains on either side. At intervals volcanoes of recent geological times are seen along it, and the floor of the valley is for the most part formed of lava or basalt, and hot springs and steam-jets are not uncommon. Its eastern wall is known as the Kikuyu escarpment, and here we found our heaviest bit of work.

From Fort Smith the road passes through a hilly country with some forest for about 14 miles, until the edge of the escarpment is reached. We had been warned by everybody we had met of the dangers of this bit of road, owing to the irreconcilable Waguruguru, who had an unpleasant habit of cutting up stragglers from caravans in that part, and with whom a constant petty warfare had been waged by the garrison of Fort Smith. Captain Sclater took half a dozen Askaris and boldly went into their country to try and get on terms with them. They turned out in hundreds, spoiling for a fight, but Sclater succeeded in explaining that he had come to shoot hippopotamus and to buy food and make friends. After a short hesitation, they conducted him to a swamp, and gave him every assistance in showing him how to get near the game. By the time he had shot at two or three hippopotamus they

were all good friends, and apparently had come to the conclusion that the Englishman was not such a bad kind of person after all. Captain Sclater had a wonderful knack of making friends with natives. In the course of the next few months I bought about 170,000 lbs. of food from them, and became a blood brother of the leading chiefs. The only trouble was that their friendship became a trifle embarrassing, as the same men who had previously made the road dangerous for all small parties felt hurt when I refused to go and live among them for the rest of my life.

At about 14 miles from Fort Smith we reached the top of the main Kikuyu escarpment, the descent of which to the Kedong river employed 300 men for about four months. For 300 yards in one place we had to blast our road out of the face of a cliff of hard grey crystalline lava. The outer portions we could displace with crowbars and levers, but as we worked into the side of the hill we had to blast. We used about 130 lbs. of dynamite and about 50 lbs. of powder. It was amusing to watch the intense interest of the natives in what they called the white man's witchcraft, the Wakikuyu being especially pleased by watching a large rock bounding down the mountains; whilst the Masai greeted that or the explosion of the blasting charges by exclaiming, "Eigh! eigh! eigh! eigh! Ngai!"

For about 30 miles from the Kedong river to Naivasha lake, little work, except some clearing of bush, was required, but at the north end of the lake the two rivers Morendat and Gilgil had to be bridged. We built simple trestle bridges over them. This took some time, as we had to cut our timber in the juniper forests which clothe that part of the escarpment, and to cart it several miles. The Morendat bridge was 120 feet long, with a 15-feet roadway supported on five framed trestles, whilst the Gilgil bridge was 35 feet long. Both these rivers are liable to prolonged floods, so that drifts would not have been reliable.

One march beyond the Gilgil river we had some heavy earth-work in descending towards Lake Elmuteita, another small independent lake beautifully situated close under the Subugo Rongai hills, which falls in terraces towards it. Three marches further on we had to bridge the Molo river, which, although usually an inconsiderable stream, is unfordable for a month at a time during the rains. Two marches more bring the traveller to the Eldoma ravine and fort. The last march required some earth-work in climbing the foothills of the Mau escarpment, and a minor bridge; but from the Kedong river to the ravine the road crosses plains, and required little work except what I have mentioned.

The bridges which we built were designed to carry a load of 3 tons, the trestles being strong enough to support much more, so that by putting in more road-bearers they could easily be strengthened to carry loads of 10 tons, if it were ever necessary.

Whilst we were busy on this section of road, a lion attacked one of our camps, and was killed by our men. The Masai identified it as a man-eater, which they said had killed a hundred of them. However that may be, he was exceedingly fat; and as it happened that we had at that time run out of cart-grease, we boiled down his carcase and obtained about 70 lbs. of fat. He kept our carts well greased for about six weeks.

Beyond the Eldoma ravine we reached the ascent to the high table-land called the Mau plateau, which forms the watershed between the rivers flowing westwards to the Victoria Nyanza, and so feeding the Nile, and those which flow eastward into the water-system of the Great Rift valley of Masailand. From the Eldoma ravine, 7200 feet above the sea, the eastern slopes rise to a summit-level of about 9500 feet in a distance of 15 miles. They are clothed with thick forest, the lower portion consisting of very large trees of juniper and other kinds which furnish good timber, whilst a dense undergrowth of very tough brush-wood makes road-making a difficult and tiresome operation. The upper slopes are somewhat easier, as the forest gives way to open grass-land, intersected by belts of thick bamboo jungle on the higher levels. The old caravan road, which was in use till the autumn of 1896, leaving the Ravine fort, often called by the Swahili word "Shimoni," crossed at once the great ravine of Eldoma, and, plunging into the dense forests I have described, passed north-westwards to the headwaters of the Nolo-sogelli river. There changing its direction to south-south-west, it follows the left bank as far as Mumia's, where the river is called the Guaso Masa.

This section from the Ravine fort to Mumia's in Kavirondo was notorious for the large losses incurred by caravans. Losses of three or four per cent. were not unknown, whilst it was rare for caravans to get through without casualty. It was eleven marches from the ravine to Mumia's; and until Kabras was reached at the eighth march, no supplies —except perhaps game—could be obtained. Even in fine, dry weather the marches were arduous, and the nights on the top of the Mau very cold; but during the rains, which in that part often continue for many months, the road was dreadful. Through the forest in the ascent of the Mau (three marches) the road was steep, winding, and narrow, and thick undergrowth which had never been properly cleared allowed insufficient headroom for loaded men, and so added immensely to their fatigue. After passing the watershed, the road, although through more open country, was still very bad, as marshes had often to be crossed which were at times deep. At the Eldoma ravine, food used to be issued to each man to last him as far as Mumia's. Experienced porters would make this last out; but the improvident, of whom there are usually many in a Swahili caravan, would often have finished their rations when hardly halfway across the uninhabited region; then, unless the caravan

leaders were skilled hunters, the weaker men perished miserably. The truth, as I have endeavoured to describe it, was sufficiently bad, but various sensational and exaggerated accounts have been published from time to time. A skilled caravan leader could reduce the casualties by taking care that the porters did not sell their blankets or waste their food, and the sacrifice of a load might save a life; but no care could prevent dysentery and pneumonia from attacking the weaker men on the inclement uplands of the Mau.

When I asked one of my headmen what he thought of the road across the Mau, he replied, "Why, sir, the Mau is nothing now; there is no mountain to climb any longer." Allowing for flattery, this shows that the natives appreciate a graded road. One distinguished officer estimated the saving of life caused by it as three or four men per month. From May to November, 1896, we had from two to five hundred men working in this region, of whom we lost but one; and as his death was probably due to heart disease, our loss through climate was *nil*. This I attribute chiefly to the issue of an increased ration to our men, which we were able to afford, owing to the efficiency of our cart transport. We had a further advantage, owing to the fact that, never having large numbers of men far away from the advanced end of our road, we could continually fill stores with food near to our working parties, and issue it every few days, thus reducing to a minimum the ill effects of improvidence among the porters. Furthermore, if a man became ill, we could transport him in carts to a less inclement climate.

Our orders were to make the road by Eldoma Ravine fort and Mumia's to Port Victoria. It had been thought until 1895 that the Eldoma ravine could not be avoided by either road or railway. It is a serious obstacle, 300 feet deep, with sides which are for the most part precipitous and nowhere of less slope than 1 : 1. Mr. Martin, when he was in charge of the Ravine fort, however, found an easy way to avoid it; and in 1896 Captain Sclater, making a more exhaustive examination of the country, discovered a direct route round the ravine to Mumia's by the Nandi country, which had been practically unknown until Major Cunningham's punitive expedition to it early in 1896. This country, being covered with thick forest and intersected by minor features, was a very difficult one in which to lay out a road; but Captain Sclater, after much labour, laid out an excellent line up a main spur, hitting off very skilfully those parts of the country where bare patches relieved us of the necessity of clearing forest. With a ruling gradient of about 1 : 20, the summit-level of the Mau plateau is reached in about 15 miles, of which two-thirds are through thick forest. From the summit-level the country is more open, and only occasional belts of forest are crossed as the road gradually descends into the Nandi country. Four minor rivers had to be bridged in this section; but as plenty of magnificent timber was at hand, this was a simple matter, and each bridge was a single

span of from 20 to 30 feet. The piers on either side were built of rough timber crib-work, pinned at the angles with 2-inch trenails of hard wood, driven home through auger-holes. The road-bearers were of large timbers, with a rough roadway fixed in a similar way.

Nandi is now reached in four or five marches from the ravine. It is a charming country lying between 6000 and 7000 feet above the sea. It is chiefly pasture of good turf, and the natives live by their flocks of goats and fat-tailed sheep and herds of humped cattle, which are here of a larger breed than any other I have seen in East Africa. They also cultivate millet and other native cereals to a small extent. It is a country of hills and valleys innumerable; in every valley is a clear stream rushing over a rocky bed. In Nandi itself you could camp at any moment, and be sure of water in the nearest hollow. The Wanandi are akin to the Masai both in language, race, and habits, and, like the latter, used to raid their weaker neighbours extensively. They do not much like being kept in order by an Englishman in the midst of them, and are not to be entirely trusted yet—at any rate, at a distance from the caravan road. A fort was built at Kamsikak, and was garrisoned by some of the Nubians, who have since mutinied. We reached Nandi in October, 1896, although we had not finished all our bridges until somewhat later.

Nandi occupies a plateau, which is sharply defined towards the south and west by what is generally known as the Nandi escarpment. To the south this is a formidable obstacle, as the land drops very steeply some 2500 feet. Fortunately for us, to the west the fall is less abrupt, although the forest which clothes the slopes and foot of the escarpment is thick, and one deep river, the Gimonde, needed bridging. We had about 12 miles of forest to work through, and about 1200 feet to descend, before reaching the open plains of Kavirondo. The Itsuka and two inferior streams had still to be crossed to reach Mumia's fort and station, but otherwise scarcely any further work was required. The bridge over the Itsuka river was the most considerable work, consisting as it did of four 20-foot spans, supported by trestle frames. From lack of carpenters, this bridge could not be finished until January, 1897. Meanwhile Captain Sclater had finished what little clearing work was required up to Mumia's, and, crossing the Guaso Masa river, had driven carts to Port Victoria, on the Victoria Nyanza, on the last day of December, 1896. The Guaso Masa river is liable to heavy and prolonged floods, and, when low, is generally 150 feet wide. To bridge it would have been a considerable work, as no timber of sufficient size could be obtained within 20 miles of Mumia's. We decided, accordingly, to build a ferry-boat suitable for taking carts across.

Early in January, 1897, Captain Sclater started for the coast to begin other work to which he had been appointed, whilst I remained to finish the ferry-boat and to complete the data for my survey as far as

Mumia's. We found Kavirondo by no means so healthy as the higher country between Kikuyu and Nandi, and in this part no European of our party escaped without suffering from more or less severe attacks of boils, or fever, or both. It is a thickly populated country, treeless, and much cultivated. The natives go about without any clothes whatever; both sexes are equally indifferent to them. This is a drawback, as, their only want being a few beads, they have no adequate inducement to work, and it is difficult to persuade them to do so. There is scarcely any game in their country except crocodiles and hippopotamus. The country is chiefly noted for its thunderstorms and hailstones.

The construction of a ferry-boat I found a matter of some difficulty, as I had not a proper supply of stores for the purpose, and, except for a few spikes and nails and some steel wire rope, I had to make or improvise all I wanted. My timber for planks I had to cut 25 miles away and cart to the spot, whilst suitable stuff for knees I obtained in the Mau forest and carted over 100 miles. I had no oakum, no white lead, no pitch, no tar. I had to make my own bolts, and most of my spikes. I even ran short of iron, and had to use native smelted iron for finishing my spikes. I built a kind of punt, 36 feet long, 10 feet wide, with sloping ends and flat bottom. I used old gunny bags and a native fibre called kongi, steeped in cart grease and hippopotamus fat, for caulking the seams. After much labour, we managed to make a ship which floated, and which was certainly of great strength and weight. I adopted a simple method of warping her across the stream, and finished my work at the end of March, when I started for the coast, and, marching hard, I reached Mombasa in the middle of May, 1897.

I found Captain Sclater preparing to start up country again. He was unwell, but, becoming better, determined to proceed. I left Mombasa by the next opportunity, and arrived in England at the end of June, 1897.

Soon afterwards I learned, to my great regret, that Captain Sclater was again very ill with fever. He was ordered home, but it was too late. The day before his ship started, symptoms of hæmaturic fever developed, and he became too ill to travel, and a few days later he died.

Among many men whom I know who are successful in dealing with the African native, I think he was second to none. He made them all love him. His tact and patience with them was inexhaustible, and his cheery manner always seemed to put them into a good temper. His name used to work like magic, and a man who claimed friendship with "Bwana Saleta," as they used to call him, was sure of a friendly reception. In Kavirondo I met with a native bard who used to greet passing caravans with an ode celebrating his praises accompanied on a native guitar.

The "Sclater road" to the Victoria Nyanza lake took about two years to accomplish. It is 400 miles long, and cost about £17,000.

The remainder of my paper is concerned with my survey work; I

cannot, I am afraid, avoid making it rather technical, although I have relegated to appendices the parts which seem to me only to concern specialists.

On leaving the coast in 1895, my object was to endeavour to complete a triangulation over as large a portion of the country as possible, filling in as much detail as I could with the plane-table. I knew that the first 100 miles would be difficult, owing to the jungle which covers it, and I hardly expected to be able to triangulate from Mombasa itself, especially as, until Kibwezi was reached, I knew I could not spare more than a day or two for the purpose. I hoped from Ndi and other mountains to connect my work with the triangulation carried out to the southward of the road by my brother consul C. S. Smith and myself whilst engaged on the Anglo-German boundary commission in 1893. I had, however, the misfortune to meet with an accident which disabled me for several days, so that I had to be carried, and could not survey. Indirectly my accident, disorganizing for a day or two my caravan, probably encouraged one of my men to desert with his load, which contained my sextant, nautical almanacs, mathematical tables, and other useful books. It was some time before I obtained fresh copies, and, having no almanac, I was prevented from doing any astronomical observations. I afterwards regretted that I did not take sights for azimuth at Mbinzau; but I did not do so, as no sights are satisfactory when not worked out at the time.

I did not succeed in doing any work of value until some time afterwards, and I added nothing to our geographical knowledge until Kibwezi.

The instruments which I used were as follows: One 5-inch transit theodolite, by Troughton & Sims, reading to minutes of arc; one 6-inch sextant by Mr. Porter (late Carey); one artificial horizon; two plane-tables; aneroid, thermometers, etc.

For the methods of calculation employed, I must refer inquirers to Appendices I., II., and III., and to the 600 pages of foolscap on which the computations are worked out.

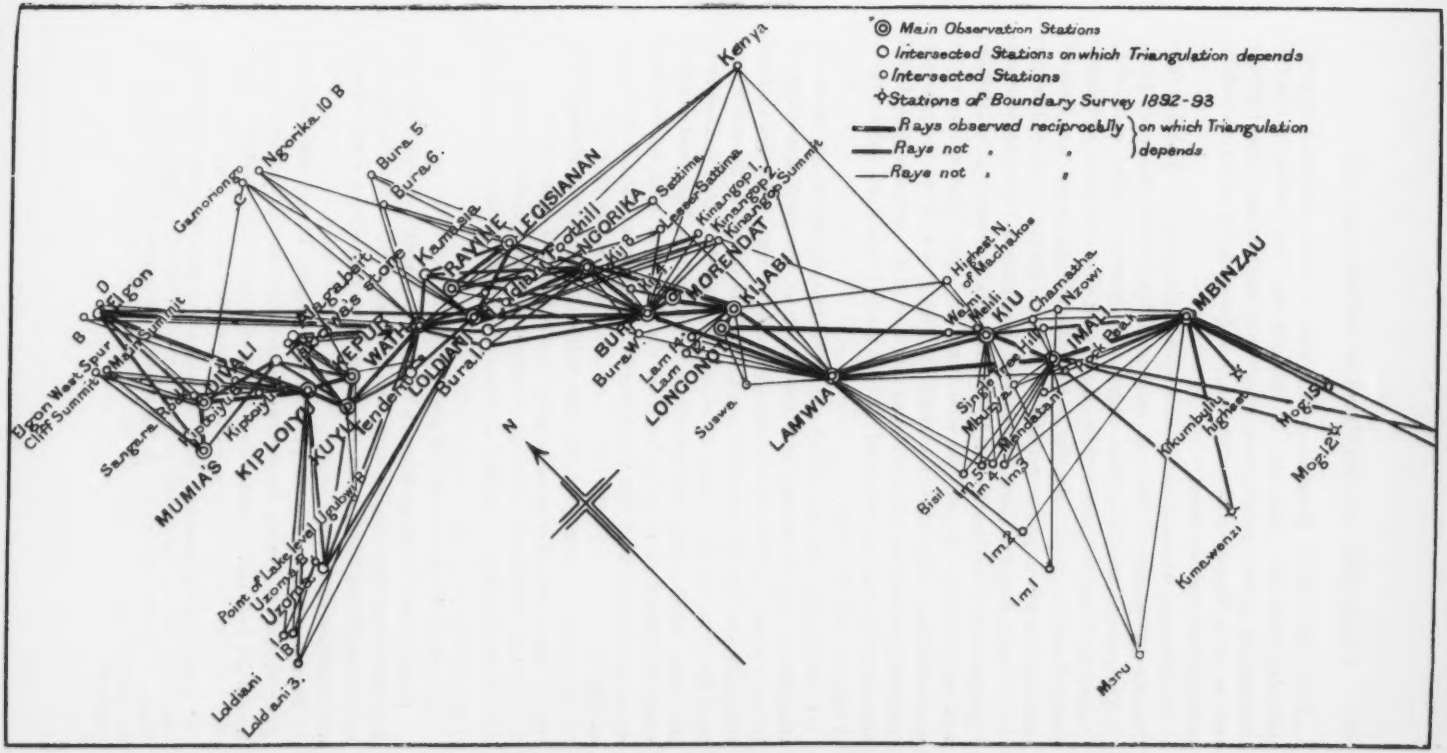
Near Kibwezi a very good peak called Mbinzau rises 1500 feet above the plains, and from its summit I began my triangulation with a set of theodolite angles. Among the peaks I observed were five which I identified as peaks whose position and height had been determined in 1892.* In order to fix my starting-point more accurately than I could do with a plane-table, I employed the method of resection, described in Appendix II., from which it can be seen that I obtain the most probable azimuth and position, and can at once determine the probable error of the result. The latter can only be looked on as a rough guide, as the number of observations (five) is not sufficient to make the theory of

* A sixth was observed with such results as to show the necessity for its revision. It turned out that an error in calculation had been made.

least squares rigidly applicable. In this case my probable error was 48 feet in distance from one of my former points. For the benefit of the unmathematical among my audience, I may explain that where several discrepant results are obtained for the same quantity, by an examination of the errors of the results, a quantity called the probable error can be obtained, which assigns a limit within which it is an even chance that the true result lies. This limit can be computed with precision where a large number of results are obtained; where the number is small, the probable error gives only a rough idea of the accuracy obtained, and in the present paper it is in this sense that my results as to probable error must be understood.

I afterwards obtained a good astronomical azimuth at Lake Naivasha, which gave a discrepancy with my resected azimuth of 3′ 38″. This correction altered the position of Mbinzau 120 feet in latitude and 340 feet in longitude, but my original position was sufficiently near for a first approximation.

About 40 miles beyond Mbinzau I obtained an excellent observation station at Imali, a sharp peak some 2000 feet above the plains at the south-west of the Ukamba country, from which I could again see several old friends. Using the resected azimuth, I cut in my position from them, so obtaining a base which was sufficiently good for a first approximation, and which had only to be slightly altered later on when I could test my scale by latitudes obtained at Naivasha. From this point onwards the work was much simpler, and, as may be seen from the diagram of triangulation, I reached Naivasha with six fairly well-shaped triangles, of which all save the first have all the angles observed. This point, close to the bridge over the Morendat, was a very good place for astronomical work. It is situated in the centre of a small plain about 10 miles across from east to west, and to north and south the mountain masses are more distant and symmetrical—a very important point in getting an accurate latitude, in order to avoid local attraction along the meridian. I observed eight pairs of circummeridian stars, each star being on the average observed ten times, and, combining these 160 individual observations, I obtained a latitude with a probable error of 83 feet, a result which could probably not be much bettered with a 6-inch sextant reading to 10″. I also obtained four pairs of east-and-west star observations of azimuth, which worked out with very small errors. The above gave me the data for arriving at a second approximation with my triangulation. I oriented my triangulation on this azimuth, and corrected my scale so that my triangulated latitude should agree with my observed latitude at Morendat. I now had obtained the second approximation for the latitudes and longitudes of my first seven observation stations. Two more well-shaped triangles brought me to Loldiani, the highest peak in the Mau range of mountains, and also the highest point I ascended—10,000 feet above the sea.


Main Observation Stations
Intersected Stations on which Triangulation depends
Intersected Stations
Stations of Boundary Survey 1892-93
Rays observed reciprocally } on which Triangulation
Rays not " " } depends
Rays not " "
Kenya
Ngorika 10 B
Gamonong
Bura 5
Bura 6.
LEGISIANAN
NGORIKA
Sattima
Lesser Sattima
Kinangop 1.
Kinangop 2.
Kinangop Summit
MORENDAT
KIJABI
Hippos' N. of Machakos
Weni
Mailli
KIU
Chamatha
Nzowi
MBINZAU
INAL
Gazi
Rock
Single tree hill
Mbuyuni
Mbondani
Kikumbuliu
Highest
Mog. 1
Mog. 2
Kimawenzi
Maru
Im 1
Im 2
Im 3
Im 4
Im 5
Bisil
LAMWIA
Suswa
LONGONOT
Lam 1.
Lam 2.
Bura W.
BURA
Bura I.
LOLDIANI
TENDENI
KUYU
KIPLONO
MUMIA'S
Sangura
Kipsoiyo
Kipsaina
Kipsigis
Tendeno
WATA
WEPUR
TABOR
Gilgbert
Kumasia
RAYINE
Foothill
Hill 8
Hill 9
Hill 10
Hill 11
Hill 12
Hill 13
Hill 14
Hill 15
Hill 16
Hill 17
Hill 18
Hill 19
Hill 20
Hill 21
Hill 22
Hill 23
Hill 24
Hill 25
Hill 26
Hill 27
Hill

From Loldiani to Mumia's, which was my final station, I proceed with six observation stations. In only one case was I able to observe three angles of the triangles, but where this could not be done, I solved two or more triangles with two angles observed, in order to obtain reliable checks on my work.

At Mumia's, which is situated in a wide plain, and is probably free from local attraction, I observed very carefully for latitude seven pairs of circummeridian stars with about ten observations for each star. Combining these 140 observations, I obtained a latitude with a probable error of only 96 feet. My sights for azimuth comprised four sets of morning and evening observations of the sun, giving a probable error of 7″. Comparing the above results with those obtained by triangulation, I got an error of azimuth of 1′ 58″, whilst the discrepancy in latitude was only 30 feet. It will be seen from the above that at the three points Mbinzau, Morendat river, and Mumia's, where I can compare my triangulation results with previous work or with astronomical determinations, the residual errors of latitude are practically nil, whilst those of azimuth are not great.

Consequently, we can infer that the orientation of my series of triangles is not far wrong, and that being so, the good agreement in latitude shows that the scale is approximately correct—provided that the triangulation is consistent with itself. This is shown in the early part from Kiu to Loldiani by the accuracy with which Kenya is fixed from four observation points, the probable error in latitude being only 19 feet, whilst in longitude it is 72 feet; and in the latter part by the good agreement obtained in the determination of other outlying points, such as Elgon.

The general accuracy of the map which I claim from these errors, which I have quoted at some length, is as follows:—

(1) All latitudes of main points correct to within 1″, or 100 feet.

(2) Longitudes * correct to 800 feet, or about 8″; errors of longitude, if any, being due to error in azimuth.

(3) Azimuth correct to 1′ of arc.

I claim, however, that the map is consistent with itself, so that if at any future time the longitudes of Mumia's and of Mbinzau be determined by telegraph, the whole of my work may be corrected by a slight change of orientation and scale.

Turning now to my computations of height, I have combined my observations in such a manner as to obtain two independent series from start to finish. One series consists of reciprocally observed vertical

* Longitudes depend on longitudes of the Anglo-German Boundary Commission of 1893, which themselves depend on the longitude assigned to Mount Jombo, near Wanga, in the Admiralty Chart. It is probable that a constant correction may have to be applied to all these longitudes on the computation of any one of them by telegraph.

angles throughout, whilst the other is equally complete as far as Loldiani, although beyond it depends on intersected points, of which in every case two or more are taken. These two series are equivalent to a single series of over 600 miles, closing on the same point. The closing error was only 25·5 feet, a surprisingly good result with a 5-inch theodolite. I used the methods employed in the Indian survey, and a good idea is formed of the regularity of the results * by examining the coefficients of refraction which I obtained from each pair of reciprocally observed angles, and which are nearly constant until the main watershed of the Mau are past, whilst afterwards they regularly increased in value to my final station. Perhaps the points of most general interest in my results are some of the determinations of height which I obtained. I have already referred to the position of Kenya † and its small probable errors. I now wish to point out that its height has been considerably exaggerated. I have worked it out from six different positions, and with a probable error of 19 feet I assign to it a height of 17,180 feet.

The next highest peak which I observed was Donyu Elgon, or Elgoin, north of Mumia's, which I found to have an altitude of 14,200 feet, with a probable error of 20 feet. This confirms the result of Lieut.-Colonel Macdonald in 1892, when the Uganda railway survey, no doubt giving round numbers, gave it a height of 14,000 feet.

I will now draw your attention to two mountains of considerable height which have been called by various names, and to one of which existence even has been denied by a distinguished geologist. They are vaguely marked on most maps as the "Aberdare range," although they have more than one excellent native name of their own. Sattima rises to a height of 13,390 feet, whilst Kinangop, or Donyu Ronyu, is 12,920 feet above the sea.‡ It seems hard on two such giants that they should have been ignored; but, although I saw and observed them many times, they are often sulky, hiding themselves in cloud for a month at a time, and from many places near to them are always hidden by intervening hills.

My determination for the height of the Victoria Nyanza was 3775 feet, which again corroborated the railway survey result of 3820 feet.

Concurrently with my trigonometrical and astronomical work, I carried on a plane-table survey on a scale of about 2 miles to the inch, which I had the opportunity of checking many times. As I could not work out my triangulation until afterwards, I had to work my plane-table independently from sheet to sheet. I began each sheet by

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* As follows: $\frac{r''}{c''} = 0{\cdot}065, 0{\cdot}059, 0{\cdot}060, 0{\cdot}058, 0{\cdot}060, 0{\cdot}063, 0{\cdot}066, 0{\cdot}076, 0{\cdot}075, 0{\cdot}077, 0{\cdot}079, 0{\cdot}088, 0{\cdot}091, 0{\cdot}093$, where r'' = angular refraction correction in seconds, c'' = distance in seconds of arc.

† Lat. 0° 9′ 13″·1 S., long. 37° 18′ 37″·2 E.; height, 17,180 feet.

‡ Sattima, lat. 0° 18′ 53″ S., long. 36° 37′ 38″ E.; Kinangop, lat. 0° 37′ 48·4″ S., long. 36° 42′ 29″.

transferring two points only, which I used as a base, so that each sheet is consistent with itself, and when re-drawn on the triangulated points most of the error disappears. I have used the Geographical Society's system of spelling throughout. I also, for purposes of reference, started a diagram of triangulation in the field on a scale of 8 miles to the inch, which saved me much labour in arriving at first approximations, forming a useful check and helping to identify distant mountains.

A good deal has appeared in the papers lately about the change of route which has been adopted for the Uganda railway, and perhaps a few remarks on the subject would not be out of place. A glance at the map will show that the originally proposed route by Eldoma ravine, Mumia's, and Port Victoria went a very long way round, and that, if a way could be found striking straight for the lake from Lake Nakuru, much distance would be saved. Captain Sclater was tied down by orders to take the road by Eldoma ravine and Mumia's; but although he was not able to see all the country, he expected that the direct route would prove easier. Whilst I was surveying in that part from various lofty hills, I saw very nearly all the country concerned, and was convinced that there lay the best route for the railway. I believe I was the first to get a fair map of the district, and our representations convinced Mr. Whitehouse, the chief engineer of the Uganda railway, that the route, which will save some half-million sterling, was worth a detailed survey. It is not generally known that Lieut.-Colonel Macdonald in '93 intended to return by this route, but was prevented by adverse circumstances.

With the exception that I obtained occasional assistance in time-taking for astronomical sights from other gentlemen, I did the whole of this survey unaided, nearly all of it in my spare time. It cost under £100. It will shortly be published by the Intelligence Department, War Office, on a scale of 1 : 250,000, or nearly 4 miles to the inch, with other work incorporated with it.

I cannot close a paper on East Africa without acknowledging heartily the hospitality and unfailing kindness of the various Government officials stationed in the Uganda and Coast Protectorate whom I have met, and wishing them every success in the somewhat lonely life which they have selected.

APPENDIX I.

Indian System of Computation.

'The Auxiliary Tables to facilitate the Calculations of the Indian Survey,' 1887, is the work employed. The formulæ used in computing are given as "Alternative Method in Secondary Triangulation," pp. 69 *et seq.*, and are more than sufficiently accurate for the instruments that I employed.

The following symbols are employed :—

λ = latitude of point A.
L = longitude ,,
A = azimuth of B from A, measured from south clockwise.
$\lambda + \Delta\lambda$ = latitude of B.
$L + \Delta L$ = longitude of B.
$\pi + A + \Delta A$ = azimuth of A from B.
c = distance AB.
ρ = radius of curvature of meridian.
ν = normal, terminated at minor axis.

$$\text{Then } \Delta\lambda = -\frac{c}{\rho}\cos\left(A + \frac{\Delta A}{2}\right)\operatorname{cosec} 1'' \quad . \quad . \quad . \quad (1)$$

$$\Delta L = -\frac{c}{r}\frac{\sin\left(A + \frac{\Delta A}{2}\right)}{\cos\left(\lambda + \frac{\Delta\lambda}{2}\right)}\operatorname{cosec} 1'' \quad . \quad . \quad . \quad (2)$$

$$\frac{\Delta A}{2} = \frac{\Delta L}{2}\sin\left(\lambda + \frac{\Delta\lambda}{2}\right) . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

$$\log\frac{\operatorname{cosec} 1''}{\rho} = \operatorname{colog} \text{ (Table XXVI.)}$$

$$\text{and } \log\frac{\operatorname{cosec} 1''}{\nu\cos\left(\lambda + \frac{\Delta\lambda}{2}\right)} = \operatorname{colog} \text{ (Table XXVII.)}$$

These equations lead to very simple computations. I allowed for spherical excess in the larger triangles, although it was hardly worth while using Table IV. for the purpose. The computations for heights are given on pp. 24 to 30. I may remark that the coefficient of refraction alluded to in the text is the quantity $\frac{r''}{c''}$, where r'' = refraction in vertical angle at A or B in seconds, and c'' = contained arc of Earth's surface between A and B in seconds.

APPENDIX II.

A method of finding the most probable position of a station from a round of angles to points of known position when the azimuth of all points is only approximately known from a plane-table resection, applying the theory of least squares.

I describe the operations. I do not propose to prove the method.

1. Choose a suitable point (A) of the known points, such that the line joining it to your station (called X) is a common side to all the triangles having XA and each of the other known points at the angles, and such that the triangles are all of fair shape.

2. Then the problem is solved when you determine distance XA and azimuth θ of X from A.

3. Take approximate azimuth θ_1 from plane-table, and solve triangle XAB (BCD . . . being other known points). This gives a value α_1 for distance XA. Recompute triangle XAB with value for azimuth a little greater and a little less than θ_1, which we call θ_2 and θ_3. This will give new values α_2, α_3 for distance XA. Similarly, compute the triangles XAC, XAD, etc., with the azimuths θ_1, θ_2, θ_3, giving values β_1, β_2, β_3, γ_1, γ_2, γ_3, etc, for distance XA.

4. Plot as abscissæ on a suitable scale the azimuths θ_1, θ_2, θ_3. Plot also on a suitable scale as ordinates the lengths α_1, α_2, α_3, β_1, β_2, β_3, etc. (It is usually more convenient to plot the log distances, which, within the limits required for this purpose, are proportional to the lengths. Then join α_1, α_2, and α_3; this line represents the locus where the ordinates are length XA, abscissæ azimuth θ. Similarly, join β_1, β_2, β_3, etc. Find a line of mean values (ordinates being means of respective ordinates of lines α_1, α_2, α_3, etc.). θ is treated as Independent variable.

5. By inspection observe about where the line of mean values differs least from lines α_1, α_2, α_3, etc. Near this point draw several ordinates. On each of these ordinates find the square root of the sum of the squares of the errors of the lines α_1, α_2, α_3, etc., on the line of mean value. (This can easily be done with a pair of compasses.) Plot on each ordinate below the axis of azimuths this length. Join the points so found by a curve, which is the locus of square root of sum of squares of the apparent errors on the mean line. The horizontal tangent to this curve touches it at the point P. Draw the ordinate PQ, cutting line of mean values in the point Q. Then the ordinate and abscissæ of point Q are respectively the distance XA and the azimuth θ when the square root of the sum of the squares of the apparent errors is a minimum. In other words, we have found the most probable distance XA and azimuth θ.

The above process can be repeated on a larger scale, if necessary. This process has the objection that it gives greater weight to one of the points A than it does to any of the others, as that point has been combined with each of the others. This method was only looked upon as giving a better value for my starting-point than I could hope to get with a small-scale plane-table. The value of azimuth obtained at Morendat was the one finally adopted. If the lines α_1, α_2, α_3, and β_1, β_2, β_3, etc., are parallel, the problem is indeterminate, A, B, C, D, . . . and X all lying on one circle.

APPENDIX III.

Slide-rule Method of computing Heights.

In surveying operations it is constantly required to find out the difference in height between two hills approximately. For minor points on a small-scale map, you do not wish to go through the labour of the rigid methods. The following method I have found to give results within about 20 feet of the rigid method up to distances of about 20 miles and angles of 1° 20′, within which most of such problems would come. On Cary's ordinary boxwood slide-rule is found a logarithmic scale twice repeated for numbers, and a logarithmic scale of sines (the difference between sines and tangents on such a scale is imperceptible below 3°), from 40′ to 90°. If the scale of sines be enlarged to nearly twice the length, we reach log sine 30″ on the left hand of the scale. To use this in the ordinary way, the scale of numbers has to be repeated five times. The problem is now in this form: Given distance (plain surface) between two points in feet and vertical angle, we get answer difference of height in feet.

But, working with a small-scale plane-table, it is much more convenient to measure off the distance in miles or geographical miles; so that, using such a slide-rule in the ordinary way, you would have to measure off distance in miles, multiply out into feet, and then proceed, using the ordinary zero of sin 90°, or a special scale of feet would be required on each sheet. This complication may be avoided by shifting your zero a suitable distance towards the left on the scale of

sines. The zero for geographical miles comes at log sin 5′ 38″ about. We can now cut off all the scale of log sines to the right of 1° 10′, and, using scale of numbers of ordinary size, we get a compact instrument. From this we can directly solve the problem, given (plain surface) distance in geographical miles, vertical angle between 30″ and 1° 10″, to find height in feet.

Now, since the correction for curvature and refraction in arc is a nearly constant ratio of the contained arc or distance, we can place a mark "K" a suitable distance from our zero, and when the zero is placed opposite the distance, "K" will be opposite the angular correction to the vertical angle. If angles of elevation be taken as positive, and of depression as negative, we have "K" always positive.

Example.— Distance A to B = 12½ geographical miles; vertical angle = −15′ 30″.

Place zero opposite 12½, then K* is opposite 5·4. Then 5′·4 = 5′ 24″ = correction.

Vertical angle = −15′ 30″
Correction = + 5′ 24″

Corrected angle = −10′ 6″

Opposite 10′ 6″ (without shifting slide-rule) will be found 151. *Answer*, B is 151 feet below A.

The above can all be done easily in the head.

APPENDIX IV.

Plotting.

I plotted my graticules in the ordinary way from the tables given in Auxiliary Tables Indian Survey. But I soon found that the convergency of the meridians was so small for latitudes of under 2° 30′ that I neglected it altogether, simply using rectangular co-ordinates of the proper length. Such plotting errors are less than that due to the stretch of the paper.

TABLE I.

Main Triangulation.

Station.	Latitude.	East Longitude.	Height.
	° ′ ″	° ′ ″	feet.
Mbinzau	2 21 12·7 S.	37 55 6·8	4,590
Imali	2 3 47·5 „	37 22 37·5	6,007
Kiu	1 46 48·9 „	37 15 0·2	6,694
Lamwia	1 25 24·4 „	36 38 18·1	8,177
Longonot	0 55 7·0 „	36 26 47·8	9,224
Kijabi	0 54 39·9 „	36 32 42·1	8,870
Bura	0 38 13·2 „	36 15 51·4	8,857
Morendat	0 40 19·9 „	36 23 25·6	6,362
Ngorika	0 18 24·5 „	36 12 58 0	7,655
Loldiani	0 6 47·7 „	35 43 32·2	10,002
Legisianan	0 1 1·0 N.	36 3 41	6,270
Ravine station... ...	0 2 58·7 „	35 43 59·3	7,239
Wath	0 2 36·2 „	35 31 30·3	9,586
Kuyu	0 1 24·0 „	35 3 51	6,859
Kepur	0 5 44·7 „	35 9 52·4	7,298
Kiptoiyu	0 11 34·5 „	34 59 2·8	6,620
Divali	0 29 26·5 „	34 36 59·4	5,080
Mumia's (east gate of fort)	0 20 14·1 „	34 28 46·3	4,425

* K is computed for a mean coefficient of refraction of 0·075.

TABLE II.

INTERSECTED POINTS ON WHICH MAIN TRIANGULATION PARTLY DEPENDS.

No. of triangles solved.	No. of vertical angles solved.	Name.	Latitude.	East Longitude.	Height.
			° ′ ″	° ′ ″	feet.
1	3	Loldiani foothill	0 9 59·3 S.	35 43 4·3	8,970
3	4	Kamasia	0 10 31·6 N.	35 41 37·9	9,264
1	3	Bura 1	0 12 54·0 S.	35 41 8·2	9,019
2	4	Uzoma	0 23 18·2 S.	34 29 34·1	5,795
1	3	Tenderit *or* Langai	0 4 45·4 S.	35 21 24·0	8,809
1	3	Alagabeit C ...	0 24 55·8 N.	35 6 16·8	6,911
1	3	Tobolwa's stone	0 23 27·9 N.	34 58 26·5	7,170
2	5	Elgon summit ...	1 6 1·6 N.	34 34 15·5	14,197

TABLE III.

INTERSECTED POINTS.

Computed from		Name.	Latitude.	East longitude.	Height.
No. of triangles.	No. of vertical angles.				
			° ′ ″	° ′ ″	feet.
4	6	Kenia	0 9 13·1 S.	37 18 37·3	17,184
3	7	Kinangop, or Donyu Ronyu	0 37 48·4 S.	36 42 29·2	12,920
3	3	Suswa	1 10 40 S.	36 20 52	7,840
2	2	Sangara	0 31 17 N.	34 36 8	5,272
2	3	Im. 1	2 42 17 S.	36 42 52	8,730
2	2	Rock peak ...	2 8 34 S.	37 22 48	5,773
2	2	Mb. 2	2 30 1 S.	36 45 1	8,410
2	3	Meru	3 15 9·5 S.	36 44 59	15,122
2	3	Bisil	2 8 28·5 S.	36 45 22	7,056
2	2	Mendatani ...	2 8 9 S.	37 14 26	6,062
2	2	Mbuzya	2 1 0 S.	37 10 18	5,725
2	2	Chamatha ...	1 52 26 S.	37 25 53	6,265
2	2	Single-tree hill	1 55 56 S.	37 26 40	6,011
2	2	Nzowi	1 55 13·5 S.	37 32 52	6,069
2	2	Mb. 3	2 13 22 S.	36 52 53	6,954
2	2	Im. 4	2 12 19 S.	36 51 54	6,946
2	2	Im. 5	2 11 0 S.	36 50 19	6,790
2	2	Wami	1 38 46 S.	37 7 56	6,366
2	2	Malili	1 45 2 S.	37 14 49	6,155
2	2	Highest just north of Machako's	1 29 10 S.	37 17 31	6,978
2	3	Sattima highest	0 18 53 S.	36 37 38	13,391
2	2	Lam. 12	0 53 19 S.	36 16 6	8,073
2	2	Lam. 14	0 51 36 S.	36 19 23	7,768
2	2	Bura West ...	0 39 4 S.	36 11 10	9,374
2	2	Bura central *a* ...	0 38 23 S.	36 14 8	9,433
2	2	Kij 4	0 31 1 S.	36 16 32	7,072
2	2	Eldalat	0 3 31 S.	35 49 43	8,019
2	2	Kinangop 1 ...	0 33 27 S.	36 40 9	11,216
2	2	Kinangop 2 ...	0 34 57 S.	36 40 49	11,420
2	2	Bura 5	0 40 23 N.	35 50 26	8,323
2	3	Ngorika 10 B ...	1 2 40 N.	35 30 36	10,360
2	2	Loldiani 3 ...	0 37 4 S.	34 8 4	7,400
2	2	Loldiani 1 B ...	0 31 17 S.	34 12 39	6,032
2	2	Uzoma B... ...	0 22 19 S.	34 29 32	5,492
2	2	Elgon D	1 7 28 N.	34 35 46	13,880

Computed from		Name.	Latitude.	East longitude.	Height.
No. of triangles.	No. of vertical angles.				
			° ′ ″	° ′ ″	feet.
2	2	Elgon west spur, main summit	0 54 28 N.	34 24 7	7,835
2	2	Elgon west spur, cliff summit	0 54 56 N.	34 22 38	7,716
2	2	Elgon B	1 7 13 N.	34 31 23	14,080
2	3	Elgon C	1 6 14 N.	34 33 18	14,060
2	4	Gamoriongo C ...	1 3 37 N.	35 24 30	10,312
2	2	Alagabeit highest	0 24 54 N.	35 5 24	7,218
2	2	Alagabeit B ...	0 24 45 N.	35 4 42	7,051
1	1	Kipt 5	0 21 18 N.	34 49 45	5,742
1	1	Kipt 6	0 27 42 N.	34 47 50	5,598
1	2	Bura central B ...	0 38 15 S.	36 13 58	9,413
1	2	Point on Victoria lake Ugubwi bay	0 16 43 S.	34 47 9	3,775
1	2	Sergoit	0 38 37 N.	35 23 23	7,910

TABLE IV.

MINOR INTERSECTED POINTS. *Positions* OBTAINED BY PLOTTING AZIMUTHS OR FROM PLANE-TABLE; *Heights*, BY SLIDE-RULE METHOD.

Number of vertical angles solved.	Name.	Latitude.	East Longitude.	Height.
		° ′ ″	° ′ ″	feet.
2	Lake Naivasha	—	—	6312
2	Top of half-transome, south end Morendat bridge*	—	—	6328
2	Subugo-Kij 8	0 22 10 S.	36 16 30	8562
2	Lesser Sattima	0 25 40 S.	36 32 20	11,174
2	Bura, 6	0 32 0 N.	35 47 15	7,695
2	Loldiani, 1	0 30 45 S.	34 11 55	6,190
2	Mwoititi	0 4 1 S.	35 27 33	8,960
2	Southern Kiu	1 57 5 S.	37 19 40	5,720
2	Woody top	1 59 5 S.	37 28 15	5,561
2	Rhino peak	1 50 35 S.	37 30 8	6,072
2	Donyu Sabuk	1 8 35 S.	37 15 31	7,137
2	Lukenia	1 29 13 S.	37 4 8	6,142
2	Knobble I.	1 25 50 S.	37 3 10	5,881
2	Knobble II.	1 32 42 S.	37 8 0	5,964
2	Lam 17	1 51 13 S.	35 57 13	7,600
2	Lam 11	2 10 5 S.	35 56 32	6,580
2	Machako's hill (south) ...	1 33 0 S.	37 16 36	6,590
2	Kiketi 1	1 47 45 S.	37 21 42	6,700
2	Kiketi 2	1 50 7 S.	37 25 35	6,650
2	Wai	0 41 10 N.	34 10 44	4,970
2	Samia highest	0 17 57 N.	34 9 19	5,280
2	Nakuru lake			5,845
1	Elmuteita lake			5,860
1	Coll to south-west of Loldiani...			8,500
1	Lowest dip in Mau heights to northward of Loldiani			8,850
2	Likipya 1...	NOTE.—For these latitude and longitude were not taken. Distances for computing height were taken from plane-table sheets.		7,520
2	Likipya 2			8,240
2	Likipya 3			8,880
1	Kepur 1			5,640
1	Kepur 2			5,000
1	Plain at base of Kepur 2 ...			4,620
1	Kepur 3			5,250
1	Kepur 4			4,840
1	Plain at base of Kepur 4 ...			4,400

Before the reading of the paper, the CHAIRMAN (Sir Charles W. Wilson, Vice-President) said: I am sorry to say that the President is unable to be here this evening to take the chair for the interesting paper which is about to be read. The paper this evening deals to a great extent with what is known as the Sclater road, named after the late Captain Sclater, who was at the head of the expedition sent out to make the road. If his life had been spared, he would have taken very high rank, if he had not been in the very front rank, amongst the pioneers of African exploration. The paper has been written by Captain Smith of the Royal Engineers, who was second in command to Captain Sclater.

After the reading of the paper, the following discussion took place:—

Major-General Sir FRANCIS DE WINTON: We are all much indebted to Captain Smith for his most excellent and interesting lecture, and I am sure I don't think there is any part of Central Africa more completely surveyed than that between Kibwezi and Mumia's. It is very difficult, unless you have been in a country of that kind, to understand the amount of work involved in such a survey and such a road as that on which Captain Smith has been employed. One has also no idea what a really useful thing it is to have a good map showing the route you have to take and the distance you have to traverse. It is one of the heart-breaking things in travelling in Africa that you never know when you are going to get to the end of your journey. The native has no idea of distance; he measures by time, and the native ideas of time are equal to his ideas of distance, *i.e.* absolutely *nil*. You go on very often marching and marching, as I have done myself, never knowing when you may get to the end of your journey; therefore maps such as these are of very great help indeed. I am very pleased to see that they have altered the line of the railway. Instead of taking it up to the north-east corner of the Victoria Nyanza, they are going to bring it out at Ugowe bay. When I was in Mombasa, I sent a party that way under Major Eric Smith to see whether that route was not practicable for a railway to Ugowe bay. It seemed the shortest, and of course in all railway-making, generally speaking, the shorter you can make a line, the cheaper it is to build, and you have less wear and tear for your rolling stock. The great advantage of a railway in tropical Africa, indeed, the whole question of a railway, may be summed up in one word—transport. If you have transport, you can bring the products of the country to the European markets at a profit; if you have no transport, you can only touch the fringe of the coast-line. You can bring certain goods down, but otherwise you have no chance of opening up the country, and the best transport of all is a railway. When I came back from the Congo, I told the King of the Belgians that until a railway was built from the head of the navigation of the lower river at Matadi to the beginning of the navigation of the upper river, although he had one of the finest properties in Central Africa, it would be of no use. Since then they have built a railway, and the revenue of that country, known as the Congo Free State, is now equal to its expenditure. This shows what can be done by energy and carefulness in opening up these tropical parts of Africa. I don't know that I have anything more to say, except to thank Captain Smith for his most interesting lecture.

Mr. O'CALLAGHAN: I cannot tell you much about the railway which has not already been published. It is now laid up to Kikuyu, a distance of 335 miles, and there is a distance of 30 miles of tolerably easy-going country to the Kikuyu escarpment, and it will for the present be carried down into the rift by temporary expedients. Up to Lake Naivasha, we follow very much Colonel Macdonald's line. From Lake Nakuro is the deviation Captain Smith speaks about, although it seems to be slightly south of the country he surveyed. So far as we know, it saves about 100 miles, but it is early yet to speak of what the engineers will be able to do. The railway is now used for transport up to Kikuyu.

Mr. RAVENSTEIN: I have had a great deal to do with African travellers and their work, and to me a man like Captain Smith is most welcome. We have had no end of men going across Africa and bringing home reports, but these were only preliminary reports. They were like flies that live for two or three days and then die and are thrown aside. We have now placed before us some work that will last. In Europe, the age of measurements, as Peschel calls it, arrived more than two hundred years ago. In tropical Africa it is only now coming. It is something like geological formations; they are not all chronologically equal. One formation in Europe may be much older than a very similar formation in Africa. Thus, while the age of measurement in Europe, and especially in England, lies much behind us, in Africa it is only just coming. You will be surprised to hear that there are thousands of men who have travelled in Africa, and compelled unfortunate people like myself, not only to read their books, but also to try to get something of use out of them. Now, the very fact that Captain Smith has made a trigonometrical survey and determined certain positions enables us to take loads of Blue-books and other books and throw them into the waste-paper basket. Rent in this country is a very serious matter, and though you may be compelled to pay rent for yourselves and your domestic animals, you are very loth to pay rent for a lot of obsolete literature. Fortunately for that class of literature, there are the Royal Geographical Society and the British Museum. They are stores which like to embody everything, and if you have literature of that sort, send it to the Royal Geographical Society.

Apart from this trigonometrical survey, which, as far as altitudes are concerned, is not of a final nature, although Captain Smith has much confidence in his results, we have very little else of the same quality. We have had d'Abbadie's in Abyssinia, we have the Royal Engineers' work in the same country, and the Italians'. Another trigonometrical survey from the Nyanza to the Tanganyika is comparatively recent; but apart from these, I do not know of any other surveys of the same class in tropical Africa. I really do hope that in future those who can influence work in Africa will insist on the work being done thoroughly. Any person can now go across Africa from coast to coast, but that is of little interest to us. If there are tourist clubs that like to give men of that class gold medals, let the tourist clubs do it; what we want are careful surveys, work giving us something like finality. Much, in this direction, requires to be done, and we have seen from Captain Smith what one man can do, and that, too, at a paltry cost of only £100. We want spirit-levellings, about which our chairman knows a great deal, having done some most interesting work of the kind himself—spirit-levellings to some of the big lakes. We have meteorological stations on these lakes, but barometrical observations are comparatively of little use until we are able to reduce them to sea-level, and this can only be done after we know the exact height of the stations. At present we can only judge the heights by estimates. Thus we travel in a vicious circle, like a circus horse that is always moving, but never gets to the goal. Now, we want spirit-levellings along the line of Captain Smith's survey. I don't say his determinations are very erroneous, but he will admit that we want something more perfect. We want another line to Lake Nyanza, and a line from Nyanza to Tanganyika. I feel quite sure this could be done at a very moderate cost, and it would prove of the utmost scientific value, giving us proper data for calculating altitudes throughout tropical Africa, based on aneroid or barometrical observations.

The CHAIRMAN: I hope you will allow me to convey a very hearty vote of thanks to Captain Smith for the extremely interesting lecture he has given us this evening. His work may be divided into two parts: the first was the construction of

the great road from the coast to the Victoria lake; and I think you will agree with me that he and the late Captain Sclater showed, during the progress of that work, a fertility of resource and a power of gaining the confidence of the natives which are beyond all praise. I always watched the career of the late Captain Sclater with the greatest interest, and I fully concur in the tribute which Captain Smith has paid to his memory this evening. The second part of the paper deals with the work done by himself, viz. the survey from the coast to the Victoria lake, and I can only say that it has been executed with great care and exactitude, and that it is a very solid contribution to our knowledge of Africa. I have looked through the appendices to his paper with very great interest, and, as an old survey-officer, I can bear testimony to the great care with which the survey has been made, to the accuracy of the observations, and to the admirable way in which the work was carried out. I hope he may be spared to make further surveys, if his inclination leads him again to Africa. It is just such surveys that are so much wanted there. I hope you will allow me to convey to him your very cordial vote of thanks.

THROUGH THE HUN KIANG GORGES; OR, NOTES OF A TOUR IN "NO MAN'S LAND," MANCHURIA.*

By ROBERT T. TURLEY.

As the attention of many is turned to North-Eastern Asia just now, perhaps a few notes on a district little known at present, but which must become of more importance in future, may be of interest.

Captain Younghusband's party traversed, some years since, the northern portion of the region in question, and a good description of that section may be found in Mr. James's able book, 'The Long White Mountain.' A reader of this book would naturally conclude that the country is almost impassable. The contrast, however, between summer and winter travel is as great as the difference in temperature, which is tropical or arctic according to season. In winter locomotion is usually rapid and easy, and the route taken by Captain Younghusband from Mukden to the Yalu can at that season be traversed by heavily laden freight-carts in eight days, though the distance is fully 250 miles. The valleys on the 42nd parallel east of Mukden run almost east and west, and where rivers and bogs are frozen, travelling on this route is easy. Once on the Yalu, a good road exists on the ice to a point not far distant from Possiet bay, which could, no doubt, be duly reached by carts. A Russian scientific party dragged a four-wheeled vehicle, before winter set in, across from Vladivostock to the fine cart-road above referred to. Teams, dragging carts with two tons of goods, were daily seen, denoting good roads, and by their large numbers a prosperous country.

"No Man's Land," or the once neutral zone, commences about 80 miles east of Mukden, from which point due east to the Yalu is about 150 miles. Further north the "neutral zone" was much wider, whilst

* Map, p. 352.

near the mouth of the Yalu it was only about 20 miles wide. This area, once a wilderness, but thrown open to settlers about 1860, was slowly occupied and brought under cultivation. Until quite recent years this cultivation did not extend far north of lat. 43°, but now the whole area is being rapidly peopled, and fully 50,000 square miles are settled and organized.

Although all maps show a palisade of stakes along the boundary, there seems but little doubt that no such ever existed. There was a rough dyke of earth across the valleys, especially where gates guarding the routes into Korea were situated, but nothing more. At the present day, certainly, no native knows of a palisade anywhere.

This land is generally very fertile, and is almost everywhere known to be rich in minerals—gold, copper, iron, coal, and silver, which have hardly as yet been touched. There are not very many high or rugged mountains, but the whole region is hilly, and in some sections wild and grand. Wide and fertile valleys abound, and if due care were taken to retain the rich forest soil on the hills, many of these could be perpetually cultivated, and good maize, etc., grown. No care is, however, taken, and the soil is soon washed off the steeper slopes, whilst, despite the warnings of Eleucius two thousand years since, the settlers—Shantung emigrants—are striving to emulate their ancestors of Eleucius's time, and do all in their power to strip the hills of all timber, and even scrub, causing droughts and floods in regions where such would otherwise scarcely be known.

The southern part of "No Man's Land" was once occupied by Koreans, who were driven out and over the Yalu by Chinese, who settled in their places. These were in turn driven out and deported westwards by the Manchus early in the seventeenth century A.D., so that a buffer, or uninhabited zone, might be formed between Chinese or Manchurian territory and Korea. It is scarcely forty years since it entailed a death penalty to settle there, but at about that time the outlaws became unmanageable, and settlers were allowed to enter. The robbers in time became peaceful and law-abiding farmers; they formed guilds, which to this day, although their former power is now largely in the hands of the regular mandarins, maintain better order than anywhere else in Manchuria. Property is still quite safe, and brigandage —the curse of Manchuria—is in these semi-wild regions, where guilds exist, practically unknown, whilst an independent and enterprising race has grown up.

Leaving Mukden early in February, we travelled almost due east for about 80 miles, going up the Hunun river as far as a place called Ying Fan, where it is joined by a large stream called the Shu tsu Huo, coming in from the east, whilst the main stream is now from the north-east. Our route followed the east river, more or less, for, being lightly equipped, we could cut corners over the spurs of hills. Heavily laden

carts follow the river. The country is very pretty, but not very wild or rugged, consisting of hills and open valleys, with a good number of inhabitants. Seventy miles from Mukden we passed Yung-ling, now a small and unimportant market town. It is, however, famous as the place where the Manchu power had its first origin, and for the tombs of five old chiefs near by.

Just beyond Yung-ling is Shing King, a small walled village, with a few dirty Manchu soldiers. It once boasted the dignity of a capital city. Five miles beyond this is the place where "No Man's Land" was entered by the so-called Korean Gate, though there is now no sign of gate or barrier. From this point to the Yalu is about 75 miles.

Twelve miles beyond Yung-ling the Shu tsu Huo river is joined by a large stream from the north-east. At the junction is the town of Shin Ping Fu, the seat of a large and flourishing trade, and the head-quarters of the district magistrate, who performs many of the duties of a prefect. This town is the emporium of a large area, trade flowing in from all sides. Timber is brought on carts and sledges, and stored until the flood season, when it is despatched on rafts to Mukden. The Mukden river is not navigable above that city. Timber is sent from Shin Ping Fu south over the hills to a place called Chien Chang, 40 miles away, where there is a large affluent of the Tai tsu Huo, which flows past Liao-yang and down to Niu-chuang. By it timber is thus sent to Niu-chuang port.

The merchants of Shin Ping Fu are enterprising. They are obtaining much of the Eastern trade, the principal articles being on the one hand gold-dust, ginseng, deerhorn, furs, medicines, and grain, and on the other foreign stuffs, especially cotton goods, lamps, and kerosine oil, for which there is evidence of a large demand. Once in "No Man's Land," there are no vexatious Manchu copyhold land laws, and no *Imperial tombs*, to restrict mining within a wide radius.

Ten miles beyond Shin Ping Fu we crossed the watershed and went down into a valley, the stream of which runs into the Fu Kiang, a tributary of the Hun Kiang, a large river flowing into the Yalu. The watershed is crossed at about 2000 feet above sea-level, but the ascent is so gradual—the ridge itself being only a few hundred feet above the valleys—that one does not realize it. In the distance, to the south-east, were some fine expanses of dense pine forests, but the best trees have already been cut down. The hills were part of a long chain called the Kang Shan Ling, the geological formation of which differs much from that of the older hills which we had been travelling through. On crossing the ridge, we found, instead of coarse granitic rocks, fine gneiss, limestone, and clay slate, with iron ore, copper, and also silver. In fact, there are many indications that this range is rich in minerals. Gold is quite abundant in some of its eastern valleys, and in one last season three thousand miners were at work; much gold was obtained,

including some quite large nuggets. Dealers purchased the gold on the spot for twenty-nine ounces of silver per ounce of gold, and sold the same in Mukden for thirty-three to thirty-five ounces of silver. Every miner has to obtain a licence; the government price is about three-hundredths of an ounce of gold per month. The local official in charge, however, doubled this amount. The gold is best and most plentiful at the head of a narrow valley called Erh Tao Ku. In another valley ten thousand men were at work some years since, and found gold plentiful; but trouble arose, and since then no work has been allowed there. The people have no idea of seeking gold except in the sand and shingle, and do not believe that it exists in solid rock.

The centre of the gold district is the town of Tung Hua Hsien, 180 miles east-south-east of Mukden. We struck the Hun Kiang to the south-west of the town, and followed its course in preference to a climb over a ridge. Travelling on the ice, we wound up through a deep gorge, with a hill of gneiss on one side, and on the other limestone which had been cut away, leaving perpendicu'ar cliffs. We emerged into a wide open valley, coming down from the east-north-east, skirted on either side by limestone hills, and opening out in many places into beautiful and fertile side valleys. The limestone is blue, but it has undergone some severe experiences, being foliated, and often changed into impure marble. The fissures have been frequently filled in with quartz, and often the strata stand up almost perpendicularly. The directions of foliation are always in a line with the valley, but irregularly. There can be but little doubt that there was once a large lake here, whose bed was raised by volcanic action; this is borne out by some bluffs of conglomerate, consisting of rounded and smooth boulders of rocks, foreign to the limestone surroundings, set in a hard matrix of red lava-mud.

Farther up the valley is a ridge coming in at right angles, consisting of ironstone, with lime, and probably much coal, for in one nook are several mines. The coal is bituminous, full of petroleum, and burns with a clear flame and hardly any smoke. It makes splendid coke, and quantities are sent down the Hun Kiang on the timber-rafts to the seaport near the mouth of the Yalu.

Coke is burnt in pits, very much as charcoal is made. The iron ore is very good, and looks like lead ore when freshly broken. The natives extract forty pounds of iron on an average from one hundred pounds of ore. It is broken into lumps about the size of small walnuts, and placed with coal-dust in dried mud cylinders. These are about 4 inches in diameter and 30 inches in depth. A bed is formed by layers of tiles, so placed that an inch space is left between each tile, the spaces being filled in with coal-dust. A mud wall surrounds this bed of tiles on three sides, the other side being open. The walls rise only a few inches above the cylinders, a hundred of which, or thereabouts, are placed in a bed. Between the cylinders is placed coal-dust, and the whole is ignited

gradually, by fire penetrating from the open side underneath the tiles. In a few hours all the mass is in a red glow and burns brightly, but much heat is wasted by the open nature of the furnace. The furnace burns out and cools down, when the congealed iron is separated from the dust and slag, and remelted in a second furnace. This latter is a crude blast furnace, made of dried mud in the form of a cauldron or bowl, 4 feet deep and 2 feet in diameter. Wood fuel is used, and a draught made by two bellows—boxes with a movable side, which is driven in and out by two men, who thus force air into the furnace. The molten metal is drained out into moulds, and cast into various articles, chiefly temple bells and plough-shares.

The iron makes very good steel; but this and wrought iron generally are made from old European iron, old horseshoes and gas-piping being in evidence in the blacksmiths' forges near by. The question arises, how can old iron be brought from Europe and delivered here, over 200 miles from the nearest river-port, more cheaply than native wrought iron, despite cheap labour, can be made?

The coal now being worked is not in beds, but has the appearance of having been pitched with great force into a gorge. The miners have gone down over 100 feet, and are still in the coal, which rises nearly to the surface, and in the coal are many roughly broken rocks of coarse gneiss. Farther north-east, towards Mao-erh Shan, we were assured that coal, splendid coal, abounds; whilst due north 100 miles away there is a mine, which is very productive even when worked by native methods. Copper is being worked, but not to any extent, still further within the hills; whilst over the Yalu, in Korea, it has been worked for ages.

There are about ten thousand families of Korean settlers to the north and east of Tung Hua Hsien. These are now under no law; the Chinese Government ignores their existence, and the Korean, since the Japanese war, has no control on this side. Previously the Chinese controlled the Koreans within its borders by a mutual arrangement, not very satisfactory to those governed. The Koreans are here a quiet, law-abiding people, but they feel their position, and yet do not like to leave their little homes, especially as they have prospered fairly well. They own their lands indirectly through Chinese, who pay the land-taxes. A stranger would not realize that there could be so many Koreans. They are a very shy and retiring people, and inhabit the nooks and higher valleys, whilst the Chinese occupy the main valleys.

In a valley called Lo Cheng Ku, we heard of a wonderful foreigner who shot small birds on the wing, having been there with others twelve years since, and no doubt it was either Captain Younghusband or Mr. Fulford. A Russian scientific expedition had been through here last autumn (1897), and its four-wheeled carriage, probably a tarantass, had caused some amusement. From Lo Cheng Ku we retraced our steps

to Tung Hua. As already mentioned, a good road for heavy traffic exists in *winter* right through from Mukden to the Yalu, passing south of the Lao Ling, which gives summer travellers trouble. Once on the Yalu, a good sledge road runs right up to near the Long White mountain, and thence across, it is said, to Possiet bay.

From Tung Hua we went south-south-west down the Hun Kiang, leaving behind us the forests and piles of timber awaiting the spring. We saw a Korean with a large dead tiger on a sledge, and some Chinese with four tigers—two of them enormous brutes—on a cart. All had been shot in the forests about Mao-erh Shan by guns set in the jungle in paths frequented by the tiger. They are generally placed near some animal that has been killed, or a bait; a string attached to the trigger causes the gun to go off, and usually, if the animal is not killed, it is so badly wounded as to fall an easy victim to the hunters. The shot usually enters the shoulder or the heart. It is very difficult to find the spot where the wound has been, it having been most carefully washed and sewn up, so as to not lessen the value of the skin.

After about 80 miles we came to the town of Huai-yen Hsien, a small place situated in a plain. The river winds with a big westerly sweep round a famous mountain north of the town. This mountain is famous, according to tradition, because five great chieftainesses, six hundred years since, had a stronghold on the top, and it is consequently called Wu-nu Shan (Five Women mountain). It rises rather steeply about 1000 feet above the plain, then in an abrupt and perpendicular cliff of basalt another 400 or 500 feet. The top is an irregular square measuring about three acres, and is quite flat, with Taoist temples, and a large pool of water in the middle. The approach is by one solitary path, and thus the hill forms a perfect retreat.

Leaving Huai-yen, we soon plunged into the beautiful and almost unknown Hun Kiang gorges. Here the river has cut a deep bed through hills for nearly 50 miles, winding in all directions. In many places, as we travelled on the ice, it was dark and weird, and not a sound broke the stillness. The water was flowing in a strong current beneath the ice, and here and there were open pools, caused generally by warm springs. These are rarely, if ever, frozen, even though the ice around is 4 feet thick. At these pools of open water we almost always saw a small black bird, which we had never before noticed—very like the common English blackbird in appearance and movements, but a little smaller. These lively birds winter in and near these pools, sitting on a ledge of ice, usually under another ledge. They dart in and catch the small fish, wading also, though their legs are short, where the water is shallow, but appear unable to swim. The common wild duck and mandarin ducks in larger numbers seem able to winter in a climate where for nights together the thermometer is below zero, given there are open pools of water which do not freeze.

The cliffs rarely rise in the gorges more than 600 feet above the river-bed, and usually about 300 feet. In many places the bed is only 150 yards wide, and in one or two much less. The rocks are black basalt, especially on the eastern side, for a long distance. Then gneiss appears, followed by an odd limestone section, and at the lower end basalt is again seen, with huge whitish-yellow rocks of quartz and also gneiss. The basaltic cliffs are often very beautiful. Owing to their columnar structure, castles, church spires, and Gothic pinnacles seem to rise sharply one above another, while miniature glaciers fill up pretty cavern-like niches. Gothic arches are filled in with ice tinted by oxide of iron, and hence look like rough stained-glass windows, whilst the white snow-covered ice below, glistening here and there in the sunlight, shows up the dark shadows in perfect relief. The castle towers and pinnacles are crowned with dwarf fir trees, and here and there a wee log-cabin is tucked away under a sheltering rock. All was quiet and in winter sleep, but every now and again carts with women and children were met going to the homes their husbands and fathers had prepared for them, taking with them all their riches, consisting of a few cattle and a little furniture. These people, originally, if not directly, from Shan-tung, make splendid settlers, being hardy and industrious. They, however, retain their ancient propensity for stripping bare the hills. They follow the wood-cutter and clear the ground by fire; they cultivate the steepest slopes and never terrace, hence the soil soon washes away, and a fresh space has then to be cleared. In time, when the land cannot support them, they begin to terrace, but most of the hills are then useless, and fuel scarce. Forest laws are much needed, and whatever power may rule, a first step must be to save the remaining forests, and to compel the people to cease the wanton waste now going on, which causes the droughts and floods which make life so uncertain in many places.

Large families are a great *desideratum* with these settlers, the boys being required for work, the girls to sell for wives. Women for wives realize four times the usual value in "No Man's Land." Again and again we met carts with salt and cotton goods, etc. These had been down to Sha Huo-tsu, or An-tung Hsien, with grain and local produce, and were returning north to various places. From Tung Hua Hsien to An-tung, the great river-port of the Yalu, 40 miles from the sea, is a distance of only seven or eight days for heavily laden carts, which, travelling on the ice to below the Hun Kiang gorges, strikes across to the Yalu by a good road. There is only one pass, and even here, thanks to the local guild, the road is well cut. The Hun Kiang turning back east-north-east, they go down on the Yalu ice-road, or more frequently stop short at one of the smaller ports.

The Yalu trade is becoming very important, and is destined in the near future to be very great indeed. Vast quantities of timber, grain,

etc., are annually shipped per sea-junks, whilst river-junks run up 600 miles, calling at the twenty odd little emporiums on the river-bank, Chinese side. There are many places, too, on the Korean bank, as well as many towns just inland. The up-stream route is somewhat slow, owing to the usually strong current.

Before leaving the Hun Kiang gorges, one must mention that near the lower part of them is a large basin with huge rocks, where there must be in flood-time an awful whirlpool; the lower end is guarded by a large quartz bluff. These whirlpool rapids smash the rafts, so that the owners build them in sections, with the logs firmly tied across each other, whilst the sections are loosely joined; even then many smash up, judging by the remains we saw. Otherwise, one would think that this river might be used for upward navigation.

Below the gorges we found that the wild silk, or oak-tree silk, was being widely cultivated. It is only of late years that it has extended so far north. There are no Korean settlers down here, but before leaving them it should be added that they have now for three years succeeded in growing paddy rice on boggy ground in "No Man's Land," under the 41st and 42nd parallels. The Chinese are naturally conservative, though in "No Man's Land" less so than usual; yet they were slow to encourage the Koreans to cultivate water-land rice. Now, however, they purchase readily all the Koreans can produce, and doubtless will themselves extend the area, as much of the bog-land in Manchuria would, were the Korean methods adopted, grow it well.

The country produces such a superabundance of food-stuffs that the present population is content not to try experiments. The rivers and streams have not a plentiful supply of good fish, although the water must be the same as that which runs into the Sungari, where the finest kinds of freshwater fish abound. Salmon, for instance, breed in vast numbers just over the hills, in rivers which connect with the cool, clear waters of the Japan sea, but none venture into those whose outlets are in the Yellow sea. That good freshwater fish might be cultivated is proved by the fact that one tributary of the Hun contains splendid trout, which are preserved for the court in Peking, whither they are sent frozen. A nice one was given to us, which reminded us of a home dish.

The Yalu, both above and below the junction with the Hun Kiang, is a noble stream; the width between the hills on either side is comparatively regular, and averages about 800 yards. The river in winter, or rather the ice, is about 500 yards across. On the Chinese side the hills generally end abruptly in almost perpendicular cliffs, wooded with scrub-oak, and composed of gneiss, mica schists, etc. The valleys often have narrow outlets opening out further inland. A short distance from the river, limestone hills extend irregularly for many miles, whilst hills composed of igneous rocks have been thrust up through them. In one

valley we found splendid white marble; in another odd blocks of marble were being gathered for lime. Lime made from marble, the natives say, is useless for dying purposes, especially with indigo, and also inferior to that made from blue-grey stone for building purposes. Asbestos is dug from one spot, and used for lamp-wicks. Silver-mining does not pay; the veins, or "threads," as the natives call them, are bedded irregularly in hard quartz, and this with their methods, together with the cheapness of the metal, makes the working of the mines useless, to say nothing of the trouble that is certain to arise with an unenlightened government.

On the Korean side of the Yalu, the hills differ somewhat from those on the Chinese side, but are said to be rich in minerals. They are much less wooded, and present no signs of oak-silk culture, which is carried on everywhere on the Chinese side, south of the Hun Kiang mouth.

The trade of the Yalu is timber. All North-East China draws its supplies hence, and but for the wanton waste it would still last for years. Next to timber, beans, bean-oil and cake rank for quantity. From An-tung, the port for sea-junks, fifty thousand tons per annum is said to be a minimum of the beans alone exported. Maize is very largely grown. It needs but little labour, growing on the steep hillsides until the soil is washed away.

The import trade bears no comparison to the needs of the people. Given better and more regular markets for their exports, the demand for European materials for clothing and for luxuries would be very great. This refers to the Chinese, whilst the border Koreans, who are the most manly, and in fact *the* traders of Korea, would be large consumers. One wonders why the Yalu has never been opened to foreign trade. Ocean steamers could find a good port at or just below An-tung (or Sha Huo-tsu), whilst smaller river steamers could run up to the Hun Kiang mouth, and tug-boats with barges could go up 600 miles. The said barges could sail down-river easily.

Leaving the Yalu, we struck north-west, and after travelling about 20 miles came on the remains of a pre-Manchu walled town, called Yang-tien. Another 10 miles brought us to Kuan-tien. The places hereabouts are all marked on the maps as cities, but all are equally empty, except Kuan-tien, which we reached at noon on the second day. It is about 55 miles from the Yalu, and is the seat of a district magistrate. According to an old stone tablet still there, this city was built about three hundred years since. The walls are nearly a mile each way, with a gateway in each wall, except the north, where there was no opening, as bad luck was feared from a certain hill in the distance. The walls were built of lava blocks, very well squared and fitted, but with no mortar, and were surmounted by brick ramparts, which have disappeared. Forty years since, old men told us, the whole city, together

with the country around, was a dense forest, famous for its deer and wild boar. Now all the land is cleared and well cultivated, whilst a small market town covers a portion of the space within the old walls.

Near the town is a beautiful hill—a comparatively modern crater—which rises gently from the plain to a height at the rim of about 600 feet. The base is about 1000 feet above sea-level. Around is a plain extending about 10 miles by 30, which was, without doubt, once a large lake surrounded by old volcanoes. Their craters had been filled up with basaltic rock, which now stands up black and rugged, whilst the old walls have been washed away. These certainly all belong to an earlier period than the crater in the plain. A river winds through the plain and around the crater's base, having cut a deep channel through at least ten well-defined beds of volcanic matter, right down to the old lake-bottom, which was upheaved, more or less, near the crater. The lake seems to have been gradually filled until its bottom rose level with its outlet. It was then drained dry, and its river cut a deep bed as above described, and rushes into a valley at a lower level to the south.

North-west and south-east of the crater for many miles, patches of land, in one place fully 2 miles square, were covered with huge volcanic bombs, the larger of basalt which had been partly remolten, the smaller of coarsely vesicular lava, while, from the iron oxide seen, others must contain much iron. This output must have been a sudden shower, as the bombs are strewn over the surface of a deposit formed subsequent to the draining of the lake.

North-west of the crater our road wound through a gorge, the side valleys of which are still filled to a great depth with burnt sand, and pebbles, black and dirty, bedded in clean sand in thick beds. In a recent cutting, worn by a stream which made a new bed for itself last year, there are trees which are now inferior lignite, and have been charred as they were swept along in the heated sand. Further north-west is another plain, rising from which is a noted mount, "The old White-headed Rocks." It rises steeply for about 2000 feet, and then two huge pinnacles, with a smaller one between, rise at a very sharp angle, almost perpendicularly, for nearly another thousand feet. The pinnacles and all the upper portion are bare white quartz rock, which looks like yellowish-white snow.

Further north-west we descend into a valley at a much lower level, and striking the Ai Kiang, a tributary of the Yalu, which empties into the latter nearly opposite the Korean town of Ai Chu, or Yi Chu, we followed it to the old frontier city of Ai Yang, now a mere village, and there emerged from the once "neutral zone." In the Ai Kiang, which is very shallow, we find beautiful boulders of conglomerate, such as the Japanese polish into balls, etc. They are

composed of pebbles, closely set in a minimum quantity of black lava as a matrix, and are usually of quartz of every colour. Here for the first time since entering the zone we met with pure granite. One bluff, however, we had seen a few miles back. The exposed surface looked like red Aberdeen granite, finely grained and pure.

A few miles beyond Ai Yang is Huang Ku, a famous though small coal-mine. It is in the old Chinese territory, and has been worked a long time. The seam is only, at the best, 2 feet thick; but it runs horizontally into the hill some little distance above the base, and is tunnelled for over half a mile. This coal is expensive, and is noted as the best for blacksmiths' use in the province. The bed has not been disturbed by volcanic action, and is easily drained. From here on to Mukden the country abounds in coal and splendid iron and limestone. The best coal can rarely be obtained, because of the water and the absence of pumping-machinery. Iron is now but little smelted; but, with European enterprise and its waterways, which can be made navigable, this will become the "Black country of Manchuria," and No Man's Land an "Eldorado." *

THE CAMBRIDGE ANTHROPOLOGICAL EXPEDITION TO TORRES STRAITS AND SARAWAK.

In 1888, Dr. A. C. Haddon, F.R.S., went to Torres Straits solely with the intention of studying the coral reefs and marine zoology of that district. When engaged in his zoological studies, Dr. Haddon's interest was attracted towards the natives, and he devoted his spare time to recording all he could learn about their past manners and customs, in addition to what he observed of their present mode of life. He was led to devote a good deal of time to the subject, as he found that none of the white residents in Torres Straits knew much about the natives, or cared about them personally, and as the natives were in some cases rapidly either dying out or becoming modified by contact with alien races. Some of the results of these investigations were published in the *Journal of the Anthropological Institute*, xix. (1890) p. 297; *Folk-lore*, i. (1890) pp. 47, 172; *Internationales Archiv für Ethnographie*, iv. (1891) p. 177; vi. (1893) p. 131; *Proceedings Royal Irish Academy*, (2) ii. (1893) p. 463, iv. (1897) p. 119; *Cunningham Memoir*, x.; *Royal Irish Academy*, 1894. All of the zoological results have not yet been published, and the geographical and geological observations were published in a joint paper, 'On the Geology of Torres Straits,' by Professors A. C. Haddon, W. J. Sollas,

* South-east of Mukden the natives have splendidly made turbine water-wheels; but they use the power, not for crushing quartz, but for grinding the bark of the elm tree into powder for incense.—R. T. T.

and G. A. J. Cole, in the *Transactions of the Royal Irish Academy*, xxx. (1894) p. 419.

The region in question is one of some interest, as it lies at the end of what Suess has termed the Australian Cordillera, with its attendant great barrier reef. This ancient continental range has been weathered down in the north to simple hills, which emerge as scattered islands across the narrowest portion of Torres Straits, and perhaps finds its northernmost extension in the isolated hill of Mabudauan, near the coast of New Guinea. The latter hill was probably at one time an island, which has been engulfed by the encroaching delta of the Fly river, and thus has become annexed to New Guinea.

There is a triple division of islands in the archipelago of Torres Straits; the lines of longitude 132° 48′ E. and 143° 29′ E. conveniently demarcate these subdivisions. The central zone is composed solely of low coral islets; in addition to such islets in the western zone, there are numerous islands of varied size, composed of old igneous rocks. To these islands reference has been made; while it is only in the eastern zone that volcanic islands, such as Erub and Mer, and the islands adjacent to them, are to be found. Great stretches as well as isolated patches of coral reef are also plentifully distributed from the western entrance of the straits to the oceanic edge of the great barrier reef.

The Murray islands, Uga and Erub, by the recent nature of their volcanic rocks, all of a basic type, belong to a line of later movements than those implicated in the Australian Cordillera, and may be regarded as pertaining to that great system of still progressing folds which are included in the Pacific "zone of fire." It does not appear to be possible to fix the date of this volcanic outburst. All that we can say is, that there are no traditions respecting it, and a good deal of subsequent weathering has taken place. It is manifestly erroneous, as is sometimes done, to mark these on maps as recent volcanoes, as this implies that they have been active within the human period, and of this we have no proof.

In some maps the Torres Straits are marked as a region of elevation; but, as has been pointed out in the paper on the geology of Torres Straits, no recent movement of elevation has taken place. Dr. Haddon's recent visit corroborates this general statement: there may have been recent slight oscillations of level, but no pronounced upheaval has occurred. Subsidence is more difficult to prove, but there is no evidence in favour of this alternative. Tennison-Woods has several times stated that the North Queensland axis is a stationary area.

The Syndics of the Pitt Press at Cambridge having agreed to publish a monograph on the Torres Straits islanders, Dr. Haddon determined to return to that locality in order to supplement and verify his earlier ethnological observations, and to do this more completely, he took out with him half a dozen colleagues. The work of the second expedition was

apportioned as follows: Dr. Haddon was responsible for the physical measurements and observations; he also recorded the manners and customs, legends, and other ethnographical data, as well as continuing his previous studies on the decorative art of British New Guinea; Dr. W. H. R. Rivers organized the researches on experimental psychology, he himself taking all the observations on vision; Dr. C. S. Myers experimented on smell, hearing, and reaction time; Dr. W. McDougall, in addition to other studies, made observations in tactile sensibility; Dr. Rivers carefully collected numerous sociological statistics, and Dr. Myers also interested himself in certain customs; Mr. S. H. Ray devoted himself to linguistics; and Dr. C. G. Seligmann chiefly studied local pathology, native medicine, and collected some of the animals and plants that are utilized by the natives.

The expedition left London on March 10, 1898, and arrived at Thursday island on April 22. On April 30 a start was made for the Murray islands, which were reached on May 6, after an unduly prolonged and uncomfortable passage.

This group was selected for detailed study on account of the difficulty of getting there. It lies out of the track of what little commerce there is; neither is it frequented by pearl-sellers or bêche-de-mer fishermen, consequently the natives have not mixed so much with Europeans and other alien races as has been the case with Erub (Darnley island) and the western group of islands. On the other hand, the islands have been subject for a quarter of a century to more or less missionary influence and teaching, with the result that most of the natives are professed Christians, and for nearly ten years English has been taught to the children. The foreign cult and civilization have undoubtedly had some effect, but experience proved that they were not detrimental for many of the purposes of the expedition. Perhaps on the whole it would not be easy to find a more favourable spot for the study of a simple and primitive people.

The various investigations were soon commenced, and all the party had made a good start when, through the kindness of the Rev. James Chalmers, of the London Missionary Society, an opportunity presented itself for a visit to the mainland of New Guinea. For several reasons it was important that certain observations should be made on natives of the south-eastern peninsula of New Guinea, as well as on some of those inhabiting the estuary of the Fly river, for the sake of comparison with the islanders. Dr. Haddon therefore took Messrs. Ray and Wilkin and Dr. Seligmann, and this party first proceeded to Delena, on Hall sound, on their way to Port Moresby, which was reached on May 31. During the absence of Sir William Macgregor, Mr. A. Musgrove, the resident magistrate, did all he could to forward the objects of the expedition, and he placed at Dr. Haddon's disposal for a fortnight the Government fore-and-aft ketch, the *Peuleule*. A fresh start was made

early on June 2, and the marine village of Kaile, or Gaile, was reached that evening. It appears that the real name of this village is Seriseri. Kapakapa, or Siruwai, as it should be called, was visited on the following day, and Dr. Haddon and Mr. Ray paid a visit to the Rev. W. G. Lawes, who has established a flourishing school for native teachers at Vatorata (Vatororuata), a healthy and beautiful spot about 1¼ mile from the sea.

On the following day Bulaa, commonly called Hula, was reached, and a stay was here made of twelve days. The natives were studied, and visits paid to the neighbouring villages of Babaka, Kamali, and Kalo, and to Keapara (usually known as Kerepunu) on the opposite side of Hood bay. On the return journey to Port Moresby, another visit was paid to Mr. Lawes and one to Mr. English, the Government agent of the Rigo district.

A stay was made at Port Moresby from June 17 to July 6. A short trip about 25 miles inland was made with Mr. Ballantyne, the Government treasurer and harbour-master, to visit the Taburi tribe; Mount Warirata was crossed at a height of 2615 feet. A number of natives from the mountains of the interior accompanied the party back to Port Moresby, and these were utilized for anthropometric purposes. On June 25 Dr. Seligmann went to visit Mr. English at Rigo, and he did not rejoin the rest of the expedition till September 14. He made one or two short trips into the interior in the Rigo and Mekeo districts, on which occasions some anthropometric and ethnographical observations were taken.

On July 7 Dr. Haddon and Messrs. Ray and Wilkin visited the Sacred Heart Mission at Yule island (Rabao). A flying visit was paid to Veifaa, a populous village about 18 miles inland, and situated near the Angabonga (St. Joseph river), the villages of Pinupaka, Mou, Babiko, Inawa, and Inawi were visited *en route*.

The Murray islands were reached on July 20. During the time Dr. Haddon and his party had been away, the psychologists had worked well, and had obtained a number of valuable and interesting results. The work of the expedition was continued in Mer, the largest of the three Murray islands, and the only one that is now permanently inhabited. Drs. Myers and MacDougall left on August 24, on their way to Borneo, and the rest left on September 8 to visit Kiwai island, at the mouth of the Fly river. A short stay was made at Saguane, where the party was hospitably entertained by the Rev. James Chalmers; a short visit was also paid to Iasa, the chief village of Kiwai island.

The expedition arrived at Mabuiag, a populous and thriving island which lies about halfway between Cape York and New Guinea. Here a stay of five weeks was made, and a considerable amount of work was accomplished. After visiting several of the other islands, Drs. Haddon

and Seligmann and Mr. Ray left Torres Straits on November 15, Dr. Rivers and Mr. Wilkin having left a short time previously.

Dr. Haddon's party arrived at Kuching, in Sarawak, on December 12, and here they had to remain till January 5; but the time was not wasted, as Dr. Haddon photographed a large number of Dayak fabrics and studied the decorative art of the natives of Sarawak in the excellent museum in Kuching; Mr. Ray also studied Malay.

Owing to the prevalence of the north-east monsoon, it was impossible to cross the Baram bar, and so the party had to proceed to Limbang, where a short stay was made, which included a visit to Brunei. The party were the guests of the hospitable Hon. O. F. Ricketts, the Resident of the Limbang district. The only practicable way to arrive at their destination was to proceed up the Limbang and its affluent the Madalam, and up the Trikan; then the foot of a spur of Mount Mulu, or Molu, was crossed, and the Baram river was reached *viâ* the Malinau and Tutau. Altogether the journey from Limbang to Marudi, or Claudetown, took eleven days.

The expedition was most hospitably entertained by Mr. Charles Hose, the Resident of the Baram district. Mr. Hose has explored the whole of his large district, which comprises some 8000 square miles of territory. The map which was published in the Society's *Journal* in March, 1893, will shortly be replaced by one of much greater detail and increased accuracy. Mr. Hose is well known as an enthusiastic naturalist, who has not only made great collections, but who has studied the habits of animals and has all the materials for a monograph of the land-vertebrates of Sarawak; it is not, however, so well known that this indefatigable enthusiast has a very intimate knowledge of the natives of Borneo, more particularly, of course, of his own district, and that he has recorded his observations in voluminous manuscripts; further, he has presented to the University of Cambridge a collection of ethnographic specimens from his district, the like of which is not to be found in any museum in Europe. Mr. Hose sent a pressing invitation to Dr. Haddon, before he started on his expedition, to visit him, with promises of helping on the objects of the expedition. All that was possible in the time available was done by Mr. Hose; and the members of the expedition who experienced his generosity feel they can scarcely adequately express their gratitude to him. Mr. Hose organized two up-river trips—one up the Tinjar and its tributaries, the Lobong and Dapoi, included an ascent of Mount Dulit; the second trip had for its main object a visit to Tama Bulan, the great Kenyah Penghulu who resides on the Pata river. The work of the expedition was brought to a close by the end of April.

FROM NJEMPS TO MARICH, SAVE, AND MUMIA'S (BRITISH EAST AFRICA).*

By Major H. H. AUSTIN, R.E.

As Colonel Macdonald has already mentioned, the expedition under his command was concentrated at Ngare Nyuki in September, 1897, and on the 21st of that month I started with the intention of proceeding to Lake Rudolf. Owing to the desertion and mutiny of our Sudanese escort, however, this destination had to be temporarily abandoned, and orders reached me subsequently to form a food depôt in Karamojo or Save instead. In five marches the column reached Little Njemps, situated to the south of Lake Baringo, on the river Nyuki—a spot familiar to me, Captain Pringle and I having visited that place formerly in 1892. The country traversed between Ngare Nyuki and this place was hilly and difficult for pack-animals, as in places a series of regular rocky escarpments had to be negotiated. Njemps, formerly a centre for Swahili caravans proceeding to Kavirondo and the great lake, has now sunk into comparative oblivion. Food is exceedingly scarce, and chiefly brought by the natives from Kamasia. In one short march of 4½ miles we reached Great Njemps, a large village surrounded by a thick boma, or fence. This place is one of the largest villages we saw during our wanderings, as it is nearly a mile in circumference. The natives are exceedingly friendly, and in appearance not unlike the Masai, though they do not possess the same warlike instincts. The large river Tigrish flows in a north-easterly direction close to Njemps, and enters the southern end of Lake Baringo. The column now struck north along the western shores of that beautiful sheet of water, in the centre of which are five picturesque islands densely wooded and very rocky. The natives on the lake possess small dug-out canoes, which they use extensively in their fishing operations. Leaving the lake, we continued still generally in a northerly direction through an uninhabited region covered with mimosa and other thorns, until we descended a deep depression and reached the outlying spurs of the Kamasia range of mountains. For the next five or six days we marched amongst these hills, following a small rocky stream known as the Karuan to its source, and here travelling was painfully slow, as the banks are densely wooded with thorns, and we were compelled to trudge along the bed of the river. At the source we crossed a low range of hills, from the pass of which we got a glorious view of the Suk plains, stretching away before us to the north and north-west, everywhere covered with a thick growth of mimosa and other trees. We took now a more westerly course towards the foot of the Elgeyo range, in order to reach the Suk settlement of Kivas.

* See map, p. 240, vol. xiv.

The river Kerio was crossed on October 10, and proved fortunately to be fordable, as I had feared it might be necessary to bridge it—an operation which Captain Pringle and I had to undertake in 1892, when we crossed it between Elgeyo and Kamasia far higher up, and there it was necessary to construct a 100-foot bridge to enable the caravan to cross. Our next march brought us to the first Suk settlement of Kivas, on the slopes of Elgeyo. Chemtulell and Weiwei, two other settlements, were passed on the following days, and Marich reached on October 14. Although these Suk had only once previously been visited by Europeans, viz. by Count Teleki and Lieut. von Höhnel, the natives at first were extremely suspicious of the advent of the white men, and discussed fighting us. However, better counsels prevailed, and they decided to make friends with us instead, and I was able to form a post at Marich, and leave a garrison there for a short time. The natives build their small hamlets high up on the hillsides, where they are secure from attack, whilst small plots of ground at the base of the hills are cultivated with mtama and Indian corn. These plots of ground are skillfully irrigated from the numerous small streams which course down the hillsides. The Suk are divided into two classes—the agricultural, who occupy the heights already referred to, possess only comparatively few flocks, and till the soil in consequence; and the pastoral, who live in the neighbourhood of the hills to the east bordering the valley of the Kerio. The latter are reputed to be very warlike, and possess, like the Turkana, numerous herds of cattle and flocks of goats and sheep; but we had no dealings with them, as they were out of our line of march.

From Marich, which is only some 3150 feet above sea-level, we followed a route hitherto untraversed by Europeans, in order to reach Save, on the northern slopes of Mount Elgon. We had found the road to Marich difficult for pack-animals, but it was incomparable to the difficulties ahead of us. We struck west now through a gap in the hills along the valley of the Muroni river. Our progress was exceedingly tedious, and after three long hard days we had only succeeded in covering a distance of 10 miles. The banks of the river were broken at intervals by steep rocky ravines, over which it was well-nigh impossible to take loaded animals. These had in consequence to be all unloaded, and their loads carried by porters sent back for this purpose. In addition, so dense was the vegetation of euphorbia and undergrowth that an immense amount of cutting had to be undertaken by those on advanced guard, to enable the animals and porters in rear to follow. As may be imagined, progress was most wearisome and slow, and yet, in spite of these trials, one could not but admire the beautiful scenery of this valley. Shut in everywhere by lofty peaks and ridges, the wild grandeur of this unknown valley would be difficult to surpass in any part of the world. Here and there small hamlets could be seen dotted high up on the hillsides on almost seemingly inaccessible peaks, the

inhabitants of which would visit our camp more from curiosity than for purposes of trade, as they had little more than a few pumpkins to hawk round the different tents. One eventful day we spent on a narrow mountain track, some 150 feet above the level of the rushing torrent below, the descent to which was almost sheer. Whilst jammed up along this track, owing to an obstruction on ahead, our ungainly camels became somewhat restive, and four of them, losing their foothold, rolled down with fearful momentum into the abyss below. Three of them fortunately landed into a deep pool, and were so little disconcerted by their terrible descent, that they calmly picked themselves up and proceeded to graze on the grass growing on the bank, in the most unconcerned manner. The fourth chose his spot with less discretion, and broke his neck in consequence, much to our grief, but to the delight of the Swahilis, to whom its flesh subsequently afforded an excellent meal.

On October 21 we made our last camp on the Muroni, which, flowing thence in a southerly direction, undoubtedly rises in Mount Chibcharagnani. For the next few days we still continued amongst the hills, until on the 24th we reached a deep rift, through which we saw extending away to the north a seemingly boundless plain, with a striking mountain in the foreground, the summit of which ended in magnificent rocky crags and bluffs. We had now reached the border of the great Karamojo plain, and the hill before us was Mount Debasien. We were clear of the hills once more, and the following day struck for the first time the river Turkwell, of which we were later to see so much during our journey to and from Lake Rudolf. Progress once more became easy and pleasant, as we traversed the grassy plain at the foot of the northern slopes of Mount Elgon.

Several fine streams were crossed during the next few days, until at length on October 30 we camped at the foot of the mountain, prior to our making the ascent to the fertile and thickly populated district of Save, situated on a plateau, some 2200 feet above the level of our camp. Our food was now exhausted, and the men had for some days past been kept on half-rations, owing to the delays and difficulties of the route through the hills. The following day, establishing a permanent post at the foot of the hill, in which a small garrison was left to look after the large quantity of stores and all our baggage animals, the ascent of the mountain was made. It proved to be a most exhausting climb, and as the men were worn out it was past 4 p.m. before the cultivated district was reached and a camp site selected. We were now at an altitude of over 6000 feet, in a most delightful climate and midst charming surroundings. The scenery everywhere was beautiful and grand, the country being well watered and cultivated, and the natives extremely friendly. The view from our lofty position away over the huge Karamojo plains was superb. To the north-west lay the marshy extent of country known as Kimama, whose main feature is the chain of small

lakes of which Mr. Jackson, who first discovered them, named the largest Lake Salisbury. These take the drainage of all the streams on the north-west of Mount Elgon, are connected with Lake Choga, recently explored by the late Captain Kirkpatrick, and so find their way into the Nile. Looking north, Mount Debasien stood out in solitary grandeur with its rugged crags and precipices, whilst away in the dim distance other mountain ranges were also visible to the north, whilst to the east a high range marked the continuation of the great Elgeyo escarpment. As Save could not supply sufficient food for our requirements, a fresh market was opened out some 12 miles distant, at Mbai, and this formed our main food-supply depôt for over a year.

About the middle of November the late Lieut. Macdonald also reached Save with a large column, having followed precisely the route of my column from Ngare Nyuki. He had intercepted a day or two before a letter sent by Colonel Macdonald, describing the fight at Lubwa's hill on October 19 against the Sudanese mutineers, and ordering me to bring down reinforcements to Usoga to assist in the operations against them. On November 16 and 19 two columns started for Lubwa's by a route to the east of Mount Elgon to Ketosh, and thence to Mumia's, where we were once more on the Uganda road. From Mount Elgon we had a foodless tract of country to traverse for ten days before reaching the fertile Ketosh country.

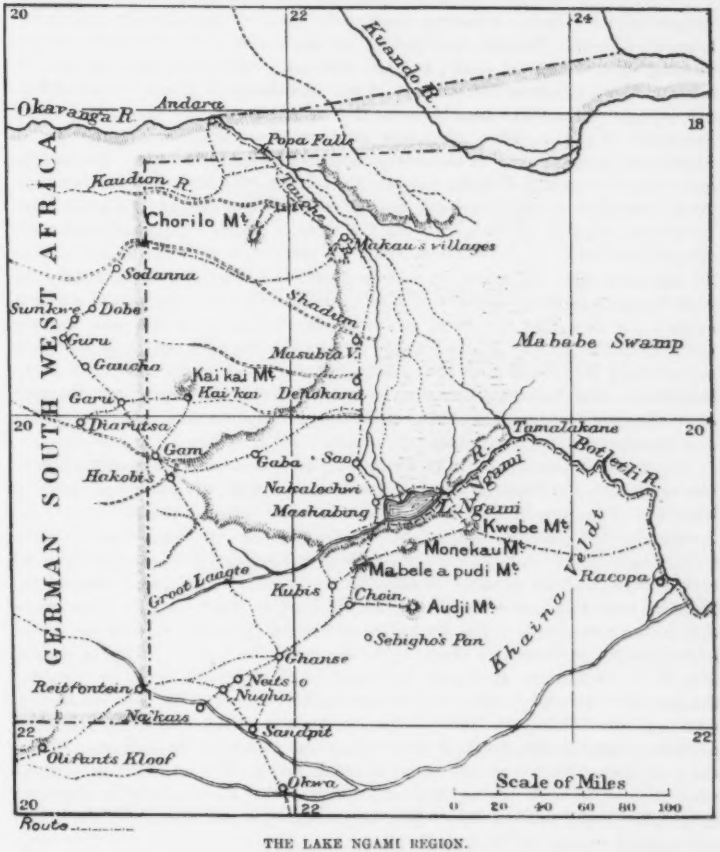
DR. PASSARGE'S JOURNEYS IN SOUTH AFRICA.*

In May, 1896, Dr. S. Passarge was engaged by the British West Charterland Company to investigate the geology and mineralogy of the company's concession in Ngamiland, in conjunction with the expedition which had set out earlier in the year under Colonel Lugard. The Kalahari had already been crossed from Palapye by the bulk of the expedition when Dr. Passarge reached that place, but the passage was made in company with an auxiliary expedition under Mr. Beddoe. The time of year—the close of the dry season—was most unpropitious, and the fact that, on account of the rinderpest, only donkeys and mules could be used increased the difficulties. Throughout the 250 miles between Palapye and the Botletli water is only to be obtained at isolated pans, the geological formation of which is of great interest. They occur where the country rock rises above the desert sands, and is hollowed out into cauldron-shaped depressions resembling craters. This rock is not usually limestone, as is the general impression, but more often sandstone, with perhaps a surface stratum of limestone. The longest interval without water was, at the time of the journey, 54 miles; but, as certain of the wells have since dried up, the distances are now much greater. During the passage Dr. Passarge was unfortunately attacked by inflammation of the lungs, so that scientific observation was out of the question. He makes, however, some interesting remarks on the relation which exists between the geology and the vegetation in the Kalahari. A comparison of different districts enables the eye to distinguish the various types of bush, uniform as this at first appears, and from its character

* Abstract of paper read at the Berlin Geographical Society, April 8, 1899.

to diagnose the nature, colour, approximate depth, proportion of earthy or vegetable matter of the soil; whilst a right understanding of the one science is impossible without a knowledge of the other.

The salt-pan of Nchokutsa, the first reached after the passage of the Kalahari, is one of the system in which the Botletli loses itself, and of which the great Makarikari is the largest. These pans are roundish or oval basins, varying from a mile or two to many miles in diameter, sunk to a depth of 30 to 45 feet in the



THE LAKE NGAMI REGION.

sandstone. Their edges are well marked and often steep. The more central ones are often filled with water, or at least with reeds, while those at the outside of the system are dry; and only at the height of the flood in the Botletli (about August) are all the pans filled. Usually the floor is dry, and, the surface layer being loosened by the crystallization of the salt, the soil gives way at every step. On arrival at the swamps of the Botletli, the scenery changes entirely. Instead of the bare and yellow bush-steppe, the eye rests on green beds of reeds traversed by old river-

channels, whilst permanent settlements are for the first time met with. The original inhabitants of the "Litaka," or reeds, were a tribe of bushmen named Mateti or Matletle, who, in contrast to their kindred of the waterless steppe, dwell in the trackless swamps of the river. A similar division between swamp and steppe bushmen is met with on the Ngami and Taukhe.

The journey along the Botletli is by far the most agreeable part of a journey in Ngamiland. The river-bed is 150 to 200 yards wide, but the stream itself only 30 to 50. The banks are 25 to 30 feet high, and form steep white walls of sand compacted with lime, contrasting finely with the deep green woods and lighter masses of reed. Bird-life is abundant on the water, and animal-life was, till recently, plentiful on the banks, but the antelope species have been decimated by the rinderpest. Beyond the junction of the Tamalakane,* which is derived from the swamps of the Okavango, there is no longer a continuous stream, but only a succession of pools. Here permanent settlements are again met with, for the abandoned river-bed supplies the only ground suitable for agriculture. The population consists in part of Makoba, in part of bushmen who have become stationary. As to Lake Ngami itself, the water has entirely disappeared, and its place is taken by a brown expanse of reeds, between the roots of which the traveller sinks into the soft treacherous soil. Water can only be obtained from wells, as a rule about 20 feet deep, and the water is often brackish. Dr. Passarge, while attributing some influence to the progressive secular desiccation to which this part of Africa is subject, considers that the cause of the sudden drying-up of the lake was the blocking of the channel of the Taukhe by the thousands of reed rafts on which the tributary Makoba brought their yearly tribute of corn to the chief town of the Batauana. Even were the channel to be again opened, the drying process has gone so far that the Taukhe could hardly suffice to again fill the lake, whose shores are now abandoned by its inhabitants.

On arrival at the Kwebe hills, which had been chosen as the headquarters of the expedition, Dr. Passarge found Colonel Lugard with the main body already installed. The range is formed of several chains, consisting of quartz-porphyry. It was the first position occupied by the Bamangwato on their invasion of the country early in the century, and was formerly well supplied with springs, but now only a few water-holes remain. It rises like an island from the sand waste of the Kalahari, and its slopes are clothed with thick wood, resembling in many ways that on the river-banks. The baobab grows in exceptional numbers, the whole hillsides being covered with them, with very small intervals. From the Kwebe hills Dr. Passarge made geological excursions in all directions, many of them for the purpose of detailed geographical and geological surveys. The most interesting was that which led north from Ghanse to Andara on the Okavango. The first permanent water in this direction is at Gam, about 130 miles from Ghanse, and it had been impossible for several years to reach this point on account of want of rain; its position also was imperfectly known, though there existed an old road, much over-grown, which had been originally made by a Boer named van Zeyl, and subsequently utilized by the trek Boers.

The first stage was at a dry river-bed—the "groot Laagte"—which forms in its lower course the Bell valley of Baines and Chapman. It must once have carried

* Dr. Passarge says that this is not really the name of the river, but of the district, all the native nomenclature being based on a subdivision of the country into such districts. The separate settlements are known after the chiefs, and are therefore subject to change, whereas the district names are as a rule invariable, remaining constant even in the case of a change in the population.

a body of water comparable to that of the Okavango of the present day. Trusting to the bushmen for guidance, and experiencing heavy rain *en route*, Dr. Passarge reached Gam in six days, in advance of his party. Provisions falling short, he made his way eastward to Ngami and Kwebe to procure a fresh supply, but, on again reaching Gam after many delays, found that his expedition had proceeded in advance to the Taukhe. After exploring the neighbourhood of Gam, Dr. Passarge made his way with difficulty, owing to the ignorance of the bushmen as to the country outside their own district, to Sodanna on the Shadum, where the old route of von François was joined. Thence the party proceeded eastwards to the Taukhe, traversing a distance of 70 miles through thick bush, instead of the 10 shown on the maps. Andara and the Popa falls were then visited. Below these falls the river-bed widens out funnel-fashion, breaking up into arms which form extensive reed and papyrus swamps, broken by wooded islands. Southwards the swamps constantly increase in extent, which, however, must formerly have been still greater. The road to Ngami leads by a network of dry river-channels through a district described as the granary of Ngamiland. The Batauana town Tsao was reached in July, 1898, and in the following October Dr. Passarge set out on his homeward journey.

REPORT ON THE INDIAN SURVEYS, 1897–98.

The Indian Survey Report, an early copy of which has just reached England, always contains interesting details of various scientific operations carried on by the Department over a very large field, often extending far beyond the frontiers of India itself. The period covered by the present report is the year ended September 30, 1898, and one of the first events chronicled is the attack made in Makran on the single party under Captain J. M. Burn, R.E., to whom was entrusted the duty of extending the main Indian triangulation westwards towards the Persian border as a basis for future surveys. Makran is a forbidding region, though one of great strategic and political importance, and it is doubtless owing to its being still very imperfectly opened up and occupied that the natives are so refractory. Captain Burn's main camp was attacked and looted, and thirteen men were killed, besides Rs. 15,000 being carried off. Captain Burn, who had been suffering from fever, was fortunately encamped on the top of a hill at a little distance from the main camp, and he and the men with him escaped with their lives, but with difficulty and hardships, as they were about 130 miles from the nearest European station. Other members of the party also managed to reach the coast in safety, but four poor fellows forming a "lamp squad" took refuge in a fort, and were killed by the natives. The punitive measures instituted by the Indian Government do not find record in the Survey Report, but it may be here recalled that Colonel Mayne was despatched to the scene with a small force, and completely routed Baluch Khan and 1500 of the rebellious tribesmen on January 31, 1898. As postal stations and trade routes have since been opened in Makran and Baluchistan, risings of this sort will be presumably rare in future.

The field surveys of the year 1897–98 were carried on by two double and seventeen ordinary parties, who were employed on trigonometrical, topographical, forest, cadastral, and traverse surveys. The aggregate survey on all scales amounted to 36,199 square miles, of which 9976 square miles were reconnaissance only. The total compares very unfavourably with that of 104,987 square miles, achieved in

the previous year, the decrease in 1897–98 being due to the small amount of reconnaissance completed in the latter season.

As for topography, three parties were engaged in the Shan States, where the hilly and intricate country, covered with tree or scrub jungle, made progress a very slow and costly matter. Most of the officers and men were much liable to fever. In accordance with a programme laid down during the previous year, a survey of the Lushai hills in Assam was commenced under Major Hodgson. No great trigonometrical survey stations exist here, so a series of first-class secondary triangles was started from the Eastern Frontier series, eventually closing on to the same series near Rangamati, in the Chittagong hill tracts. The stations were selected beforehand with the aid of the maps and charts of the previous surveys during the military expedition of 1871, and in 1889. The hills consist of high parallel ranges running generally north and south, and divided by deep valleys. The Lushai villages are generally perched on the tops of hills or on projecting spurs, and in the dry season the water-supply is often a great distance away. They are abandoned every four or five years, when a whole village community will move to a fresh site, build a new village, and make new clearances. Permanent villages are thus unknown, and no steps have been taken to mark the villages as such on the maps.

Tidal observations were taken at thirteen stations between Suez and Port Blair, and the predictions of results at the open coast stations were satisfactory, 70 per cent. of them being within fifteen minutes in time, and 94 per cent. within 8 inches in height of actuals.

The survey operations carried out in connection with the Burma-China Boundary Commission during 1897–98 are described at some length by Major F. B. Longe, R.E., and Captain T. F. B. Renny-Tailyour, R.E., who were deputed with the southern and northern sections of the commission respectively. The operations grew out of the Convention concluded in 1894 between Great Britain and China, whereby the boundary between Burma and Yunnan was defined. The Chinese Government, however, failed to abide by the stipulations, and after further negotiations an "Agreement" was signed in Peking on February 4, 1897. Both convention and agreement had to be annulled by the Joint Commission, and owing to mistranslation in the Chinese version, and to the absence of proper instructions from the Tsungli-Yamen, endless trouble arose.

The two commissions, British and Chinese, met at Bhamo, and after a good deal of discussion it was decided that the whole party should divide into two sections, one, consisting of Mr. E. George, C.I.E., and Chen, the magistrate of Milo, going northward, and the other, under Mr. H. Thirkell White, C.I.E., and General Liu, proceeding southward. The latter proceeded to the frontier, and established a camp at a spot called Lwe Leing, on the banks of the Nam-pa-kha, where the embassies from Burma to China in former days used to be met by the Chinese authorities, and where the escorts were changed, the meaning of the name being "the place where presents are given." Here intelligence was brought that neighbouring Kachins were assembling to attack the British camp; so, after a conference with General Liu, a move was made to Lwe Long, where the party were in heliographic communication with Bhamo, and where they remained till the camp broke up in April. Early in February one of the most powerful of the local Sawbwas proceeded to erect stockades to bar the British advance, and, General Liu having declared that it was within the rights of the villagers to take any means they pleased to protect their villages, a warning was addressed to the Sawbwa, and the Government of Burma was communicated with. A detachment of military police, under Lieut. Langtry, arrived from Bhamo and carried the stockades, the Chinese

being put to flight, with the loss of seven dead, twenty-five prisoners and nine standards being left in the hands of the British.

The Commission broke up on April 2, having achieved no settlement of the points in dispute, though Major Longe was enabled to do a considerable amount of survey work, and a great deal of triangulation was carried out and computed, so as to fix points and get a general knowledge of the country for the ensuing season's work.

The country through which the southern section worked lay between the Taping on the north and the Namwan on the south, the direction of the streams being south-west. The hills are very steep and rugged, the valleys deep and little cultivated. Having been for time immemorial subjected to the devastating system of *taungya* cultivation, the hills are much more bare of real forest than one would expect.

Water is abundant, though it is curious that no fish exceeding an inch in length was ever observed! Game was not abundant, but by dint of great perseverance Mr. Warry, the Chinese adviser, secured a few silver pheasants, bamboo partridges, and francolin. Sambhur and barking deer are to be had, but are rare. A fine bear was killed close to the camp at Lwe Long.

The northern section had to survey and demarcate the boundary from where the Nampaung river joined the Taping river northward to a high peak, the approximate position of which was supposed to be lat. 25° 35′, and long. 98° 14′ E. The country was not well known, and the Chinese commissioner protested he could not go the whole way, as he could ride "no better than a turtle." In spite of many difficulties raised by the Chinese, 4750 square miles were triangulated, 690 square miles were surveyed on the 1-inch scale along the boundary, as well as 1960 square miles on the $\frac{1}{4}$-inch scale. Captain Renny-Tailyour also carried the triangulation throughout, and observed from twenty stations and fixed 132 intersected points, including as many distant hills in China as possible.

THE MONTHLY RECORD.

EUROPE.

Minima of Temperature on British Mountain-tops. — Since the winter of 1867–68 a regular record of the minimum winter temperature on the Glyder-fach, near Snowdon, has been kept, first by Mr. H. B. Biden, and after his death by Mr. Piffe Brown. In reprinting the table lately published by the latter in the *Climbers' Club Journal*, the editor of *Symons's Monthly Meteorological Magazine* calls attention to the contradictory nature of the evidence we at present possess with respect to such temperatures. The minima on the Glyder-fach (3262 feet) were far from so low as might have been expected, the average for the twelve years 1884–96 being 14°·7 Fahr., and for the whole series of years from 1867, 16°, while the lowest recorded temperature was 8°. At Llandudno, at a height of 90 feet, the twelve years' average was 23°·6, giving a difference of only 8°·9 between the two stations. The same average on Ben Nevis (4407 feet) was 7°·5, and at Fort William (35 feet), 17°·3, a difference of 9°·8. On the other hand, the minimum temperatures for the summit of Scafell Pike, as recorded by Dr. J. F. Miller in 1848–50, are extraordinarily low in many cases, 31° *below zero* being registered in January and February, 1850, while other minima considerably below the same point are also recorded. The desirability of renewed efforts to ascertain the facts is, as the editor remarks, beyond question.

Recent Glacier Investigations.—At a meeting of the Vienna Geographical Society in November last, Prof. E. Richter, President of the International Glacier Commission, delivered an address * on recent continental researches on the motion of glaciers and the problems connected therewith which still await solution. After touching briefly on the early labours of Agassiz, Forbes, Faraday, and others, and the new impulse to the study given by the formation in 1869 of a glacier-commission of the Swiss Alpine Club, the speaker dwelt on the researches of Forel on the oscillations of glaciers, which he explained by the variations in the mass of the flowing ice, this being subject to the same law by which a deep river flows more rapidly than a shallow one of the same breadth and fall. The speaker himself had extended this law by a study of the interval of time which elapses between the accumulation in the region of the *névé* and the beginning of the advance at the glacier snout, holding that under the action of the increase in volume of the upper portion of the frozen stream, an advance of the snout takes place *long before* any particle of ice can reach it from the augmented masses in its rear. A further contribution to the subject was supplied by Brückner's researches on changes of climate, together with the demonstration by Richter that the Alpine glaciers had, during the last three centuries, shown a tendency to advance, roughly speaking, every thirty-five years. Increased attention has been paid within the last few years to glaciers marked by a sudden advance with devastating action, such as, among others, the famous Vernagt Glacier in the Tirol. This has shown that it is impossible, without the most accurate mapping of the environs of the glacier, and constant revision of the same, to determine the cause of the phenomenon and the proper means of protection against its catastrophic action. Of great interest also, in connection with the study of glaciers, were the contributions of Ratzel and his school towards a more correct definition of the idea of the "snow-level," extended by the work of Penck, Brückner, and Richter himself. The last named had already refuted the current notion that the snow-limit rises in the Alps from west to east, by showing that in the eastern Alps it lies at a comparatively low level on the northern and southern margin of the range, but rises in altitude towards the more temperate central portion. Recent investigation has shown that an extreme difference of at least 2000 feet occurs. Although this depends partially on the greater dryness of the interior parts of the range, Prof. Brückner has supplied the true explanation by showing that, during the warmest hours of the day, the same temperature is found at a much higher level in the centre than on the outskirts of the Alps. The speaker laid particular stress on the value of the results obtained by Finsterwalder in his endeavour to apply a geometrical treatment to the question of glacier motion. It has led him to propound a new theory of moraine motion, which supposes the material collected at the upper end of the *névé* to be covered by successive layers of snow during its passage downward, so that it finally becomes incorporated with the ground moraine. The study of glaciers has now reached a turning-point, and Prof. Richter thus formulates the principal problems brought to the front by recent research: (1) The determination of the relation which exists between the cessation of a glacier's advance and the rate of motion of the ice; (2) the resumption of the study of physico-thermal questions, preceded by a clear definition of terms.

ASIA.

Steam Navigation on the Upper Yang-tse.—The subject of the navigability by steam-vessels of the rapids of the upper Yang-tse has lately been fully

* The report of Dr. Richter's address appears in the first number of a new publication commenced this year, under the title *Abhandlungen der K.K. Geographischen Gesellschaft in Wien.*

discussed by Father Chevalier, S.J., in a brochure published at the Zi-ka-wei observatory at Shanghai. His remarks are based on a survey of the rapids executed by him during a voyage to Ping-shan on the upper river, the results of which will eventually be published at the same observatory in an atlas of sixty-five sheets, with explanatory letterpress. One of the sheets, and extracts from others, are issued with the present brochure, and, besides elucidating M. Chevalier's description of the principal rapids, they are an indication of the value which will attach to the completed work. The charts are on the large scale of 1 : 25,000, and show a complete series of soundings as well as minute details as to the nature of the river-banks and the position of rocks and sandbanks. After quoting the unfavourable judgment pronounced by Lieut. Dawson after his examination of the rapids in 1869, M. Chevalier gives reasons for not considering this verdict final, and carefully examines the separate rapids with reference to the special difficulties to navigation which they present. During his voyage he carried out an extensive series of soundings, the lead being cast every three minutes during the passage from Sui-chau to Ichang. The result is to show that a sufficient depth is everywhere present, even at low water, no sounding giving a depth less than 4 metres (13 feet), while at mean level the passage can be made by vessels drawing from 6 to 7 metres (20 to 23 feet). Again, no really torrential current was experienced during the voyage, nor any bar across the stream, nor any narrows with a pass less than 100 yards wide. At two places only does M. Chevalier see a difficulty in the way of a vessel ascending by steam power only, and in these cases he thinks that an iron cable attached to the bank and hauled upon by the steam-windlass would enable it to be surmounted. The three most dangerous rapids are the Sin Tan, or new rapid of Yun-Yang, the I Tan, and the Sin Tan of Kwei-chau. The first named is that which owes its danger to the landslip which occurred in 1896. This greatly narrowed the navigable channel, but it is still over 100 yards wide, and as the current has been carefully estimated at not over 6 knots, it should prove no insurmountable obstacle. M. Chevalier urges the importance of a trained service of pilots thoroughly acquainted with the state of the channel at each of the rapids.

Trans-Siberian Railway.—The idea of establishing across Lake Baikal a communication by means of powerful ice-breakers upon which whole trains would be carried over the lake has been abandoned, and work has begun on the railway around the southern shore of the lake.

AFRICA.

Livingstone's Tree.—It will be remembered that when Mr. Weatherley, in 1896, visited the spot where Livingstone died, he reported that the tree which marked the spot, and on which the commemorative inscription was cut by the great traveller's followers, was in such a state of decay that it must fall before long, and the inscription be lost for ever. After the reading, before our Society, of Mr. Weatherley's paper, the suggestion was made by Mr. Alfred Sharpe that steps should be taken to cut out the section of the tree containing the inscription, and bring it home to be kept with other Livingstone relics. After Mr. Sharpe's return to Africa arrangements were made to carry the idea into execution, and Mr. R. Codrington started in April last from Fort Jameson to visit the site of Chitambo's village, and carry out the necessary measures. Writing on June 19 last, Mr. Sharpe informs us that the expedition has been successfully accomplished, Mr. Codrington having arrived at Ikawa, one of the Chartered Company's stations on the Tanganyika plateau, bringing the section with the inscription. This news was received by telegraph, but Mr. Sharpe had previously received news of the arrival

of the party at Chitambo's, together with the Journal kept by Mr. Codrington *en route*. This he has kindly forwarded to us, and from it we take the following details respecting the journey. From Fort Jameson, between Lake Nyasa and the Loangwa river, Mr. Codrington proceeded west, passing though much uninhabited but well-watered country, broken by some hills, to the Loangwa, which was crossed near Sunda's village. The river was only 4 feet deep at the deepest part, and 350 yards across. Mr. Codrington made use of a folding boat for the passage, which proved satisfactory. The Muchinga range was crossed near Chilenga, the greatest altitude of the path being 4950 feet, though some peaks rise to 5500 feet. The ascent was steep, with occasional ledges, and the hills were covered with msuku forest. Passing near Moir's lake, the expedition traversed a level rolling country with light forest and some stray kopjes. The Molembo was crossed, and later the Lohombo, a deep stream 30 yards wide with steep banks. It rises near the Irumi hills, and flows to the Luapula.* Chitambo was found to be an intelligent man, about thirty years old; he succeeded his father, who died in the same year as Livingstone, and was buried under the same mpundu tree which sheltered the explorer's remains. The chief acted as guide to the spot, and the men were set to work felling the tree, which proved very hollow inside. The inscription (which we reproduce) was partially defaced by borers, etc., so that it is fortunate that it

D^R LIVINGSTONE

MAY 4, 1873

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has been secured without further delay. The section when cut proved too heavy, and had to be much reduced in size to form a practicable load, but this was at last accomplished. The tree, which is of the kind known about Blantyre as mpembu, was too old to produce seeds. The spot on which it stood was temporarily marked by an iron telegraph pole. Throughout the journey Mr. Codrington made observations for altitude with boiling-point thermometer, and his companion, Mr. Leger, made a careful map. The return was accomplished *viâ* the Chambezi and the Awemba country.

Captain Wellby's Explorations in the Lake Rudolf Region.—Writing to the Society on July 15 from Omdurman, Captain Wellby announced his safe arrival at that town after a most successful journey. After traversing the southern districts of Abyssinia (*Journal*, vol. xiii. p. 553) and satisfying himself that the Omo flows into Lake Rudolf, he had struck south along the east shore of the lake, but an attempt to explore the country further east failed owing to the loss of more than half his transport animals. For a distance of 30 or 40 miles east of the lake not a drop of water was found. Passing Teleki's volcano,† the expedition struck west for about 130 miles, and then travelled north about midway between Lake

* The Lohombo was crossed for the second time 16 miles from Chitambo's, and must therefore join the Molembo much further to the east than is shown in Thomson's map.

† Mr. Cavendish reported that this volcano had entirely disappeared. Possibly Captain Wellby refers to the new crater, said to have opened out 3 miles further south, which was, however, only about 130 feet high in 1897.

Rudolf and the Nile, through a fine country well wooded and abounding in game. It consists of a succession of well-watered valleys and ranges of hills running north and south. A small river called Ruzi (possibly the name means "river"), coming from a long distance south, flows into the stream called Juba on recent maps. Eventually Captain Wellby reached the Anglo-Egyptian fort at Nasser, on the Sobat, in the neighbourhood of which, owing to the swamps, sickness for the first time prevailed among his men. During the journey plane-table work on the scale of 4 miles to the inch was carried out by Dafadar Shahzad Mir, whilst Captain Wellby took observations for latitude, height, and temperature. Friendly relations were maintained throughout with the natives, of whom a great variety of tribes were encountered. The Turkana were found to be a very fine race, many of them approaching a height of 7 feet. They wear a mass of matted hair hanging down their backs to the waist, and in it they carry their tobacco and various knick-knacks. Owing to a dearth of boats, Captain Wellby would be forced to remain three weeks at Omdurman, which he describes as a clean and healthy place, thanks to the energy of the authorities.

M. Fourneau's Expedition in the French Congo.—The expedition under M. Fourneau alluded to in the May number of the *Journal* has since made its way successfully from the upper Sanga to the coast by way of the Komo, a tributary of the Ogowe. The land journey is said to have led in part through thick forests inhabited by Pahuin cannibals.

The Depth of Lake Nyasa.—We have received a telegram from Mr. J. E. Moore, in command of the scientific expedition to the Central African lakes, announcing, as the result of his soundings in Lake Nyasa, that the greatest depth amounts to 430 fathoms. Although it has been known, since the first exploration of the lake by Drs. Livingstone and Kirk, that great depths exist, all previous attempts to discover the actual maximum have failed through the insufficient length of the sounding-lines. In the paper presented to the Society by Mr. Alfred Sharpe in 1896 (*Journal*, vol. vii. p. 368), some account was given of the results of Lieut. Gurney's soundings, which showed that a considerable area in the northern half of the lake exceeded the depth of 300 fathoms, which was the maximum length of wire possessed by the gunboats. Great depths have been found, too, at the extreme northern end, but the southern end appears to be shallower, though, according to Dr. Cross (*Journal*, vol. v. p. 123), no bottom has been found here with a line of 200 fathoms. Lieut. Rhoades's map (*Journal*, vol. xii. p. 648) shows a considerable number of soundings, but these are mostly in the vicinity of the shores and in the southern half of the lake. The deepest inserted on the map lies off Deep bay, in the north-west of the lake, no bottom having been found at 100 fathoms.

Map of Lake Nyasa.—Lieut. Rhoades writes with reference to the notice of the map of Lake Nyasa by himself and Lieut. Phillips, p. 580, vol. xii. of this *Journal*, that his longitudes were not taken from Mr. O'Neill's longitudes of Blantyre. They were worked back from Natal, where he got Greenwich mean time and found his rate to correspond with the rates he got on the lake. His longitude of Nkata bay, midway up the lake, is the same as that made by the Boundary Commission from Cape Town. It should be stated that Lieut. Rhoades did the work entirely at his own cost, having had to purchase his own chronometer (one of Blockley's) and instruments.

Mr. Weatherley's Explorations in the Bangweolo Region.—Towards the end of last year Mr. Weatherley continued his explorations in the region of Lake Bangweolo, again making use of his boat, the *Vigilant*, in which he had previously made the tour of the lake. After descending the Luapula for a few miles from its

exit from Bangweolo, the traveller crossed over a strip of firm ground named Kapalı, covered in the forest, which separates that stream from Lake Kampolombo. The latter is separated from Bangweolo by a tract of marshy ground, but seems to have formerly occupied a larger area. Two other marshy lagoons communicate with it.

French Expeditions in the Western Sudan.—During the past year the French have been actively extending their operations in the region east and south of Timbuktu, and geographical results of some importance have been obtained by the expeditions sent out. That under Captains Voulet and Chanoine set out last year in two detachments, the one under Captain Voulet descending the Niger past Timbuktu, the other under Captain Chanoine striking across the bend of the river by land from Jenne, on its western limb. According to a brief account in the *Comptes Rendus* of the Paris Geographical Society, the latter column made its way, by a pass between Yarro and So, across the mountain range of Bandiagara, which, with a total length of over 600 miles, extends northwards beyond Hombori to the Niger, and even further. It forms a well-marked line of division between the basin of the upper Niger and those of the middle Niger and the Volta. The mountains are inhabited by the Tomas, a black race named Habe by the Fulbe. Descending the mountains, Captain Chanoine proceeded east-south-east to Wabiguya, in Yatenga, and afterwards reached a vast sandy plain named Seno, badly watered, but covered with trees. Passing subsequently through a marshy tract at the sources of the two Voltas, he reached Wagadugu, whence he proceeded to Say. Then ascending the Niger, he, on January 2, effected a junction with Captain Voulet's force, which had successfully descended the river, at Sansanne Hausa. The latest news to hand with regard to the united expedition is summed up in the July number of the *Bulletin du Comité de l'Afrique Française*. Hostilities broke out between the mission and the Tuareg, which, however, ended in the triumph of the French. Accusations of undue severity in the treatment of the natives having been made against MM. Voulet and Chanoine, the investigation of the matter has been entrusted to Colonel Klobb, who will, in case of need, take over the command. The number of the *Comptes Rendus* above alluded to also contains some details respecting the expedition for the exploration of the upper Kavalli under MM. Hostains and d'Ollone, to which reference was made in our August number. Starting from Bereby rock, on the Ivory Coast, in order to avoid the hostilities on the lower Kavalli, the party reached, on March 15 last, the Duo river (apparently the Diwu of Blondiaux), which unites with the Duobe to form the so-called Kavalli —a name unknown to the natives. The Duo comes from the east-north-east, but makes a bend to the north-west. It receives an important tributary named Hanna. The expedition was about to push further northwards, where, however, the tribes were described as hostile.

The Béhagle Mission to Lake Chad.—News of this expedition, dated January 1, 1899, is published in the May number of the *Comptes Rendus* of the Paris Geographical Society. At the date mentioned M. de Béhagle was at the source of the Gribingi (which, according to a sketch-map accompanying the note, lies in about 6° 20′ N., 20° 5′ E.), having surveyed the whole course of the river between 6° 20′ and 8° 40′ N. Previous information (*Comptes Rendus*, 1899, p. 60) had stated that he had surveyed both the Gribingi and Shari to 10° N., as well as the Bamingi, the principal branch of the Shari, for ten days' journey above the mouth of the Gribingi. In the sketch-map above alluded to (by M. de Béhagle himself) the lower course of the Gribingi appears as a dotted line, while there is a break in the itinerary between the upper Gribingi and the Bamingi, so that it is not clear by what route the latter was reached. During a reconnaissance in the

country east of the Gribingi, M. de Béhagle seems to have approached the upper basin of the Bamingi, having crossed the Paima, one of its western tributaries; he also speaks of having discovered holes and fissures in the felspathic rocks at Nembrua (not marked on his map) which may possibly have served as habitations of the natives in former ages. During the journey from the Ubangi, the upper course of the Tumi and the country to the west of its source were explored by M. Mercuri.

Geographical Work in German East Africa.—Several items of interest as regards the geography of German East Africa appear in the first two numbers of the *Mitteilungen aus den Deutschen Schutzgebieten* for the present year. The first number contains a fresh instalment of the careful astronomical observations of Captain Ramsay during his journeys east and north of Tanganyika in 1897. They are almost entirely confined to latitudes, only two trustworthy values for longitude having resulted from the lunar observations. The various observations for latitude agree well as a rule, and the mean error during the journey rarely appears to exceed $\pm$ 0″·2. A large number of observations were taken for the latitude of Ujiji, the mean result (obtained by taking the average of the daily means) being 4° 55′ 6″ S. Herr Ambronn (by whom the results are computed) notes, however, as difficult of explanation, that the daily means show a progressive diminution in value. Another careful series of observations, for latitude, magnetic declination, and altitude, was carried out by Dr. Maurer between the coast and Kilimanjaro. The altitudes were determined by aneroid, checked by frequent boiling-point observations, and compared with simultaneous observations at Dar-es-Salaam. A large number were taken at various points on Kilimanjaro up to a height of 15,350 feet, at which altitude patches of snow were lying in sheltered spots on March 2. Other observations give the altitudes of the various changes in the character of the vegetation, etc. The same number contains a large-scale map of the island of Ukerewe, in the Victoria Nyanza, from a survey by Captain Herrmann, who made the complete circuit of the island by land as well as a journey across the eastern end. The outline, especially in the west and north, receives some considerable modifications. The whole interior of the island (which is 25 miles long, with a maximum breadth of about 12) consists of wooded hilly country, quite uninhabited, rising to a height of about 650 feet above the lake. In the west the flora has West African affinities. Formerly elephants were met with in large numbers, but now that the channel to the east has become unfordable only three remain. Captain Herrmann has also executed detailed surveys in Bukoba, west of the Victoria Nyanza, and a large-scale map of the northern part of the district, south of the lower Kagera, appears in the second number of the *Mitteilungen*. In the north-east the survey is said to be complete both as regards surface features and localities, while the shores of the lake were plotted in both from the land and the water. Captain Herrmann carried his survey on both sides of the Ngono, a southern tributary of the Kagera which flows for a long distance parallel to the lake-shores with an interval of only 4 miles. He has also completed the survey of Lake Ikimba. The whole country east of the lower Kagera is intersected with swampy steppes separated by ridges of higher ground. These, like the higher parts of the country generally, are largely covered with banana plantations, while large patches of forest with West African flora occur at a lower level. The mouth of the Kagera does not, as has been supposed, enter a bay, but forms a delta projecting far into the lake. Captain Herrmann has been transferred to Tabora before completing his map of the country, one of the principal points requiring examination being the contour of Lake Urigi, which, he says, differs considerably from that shown by Stanley.

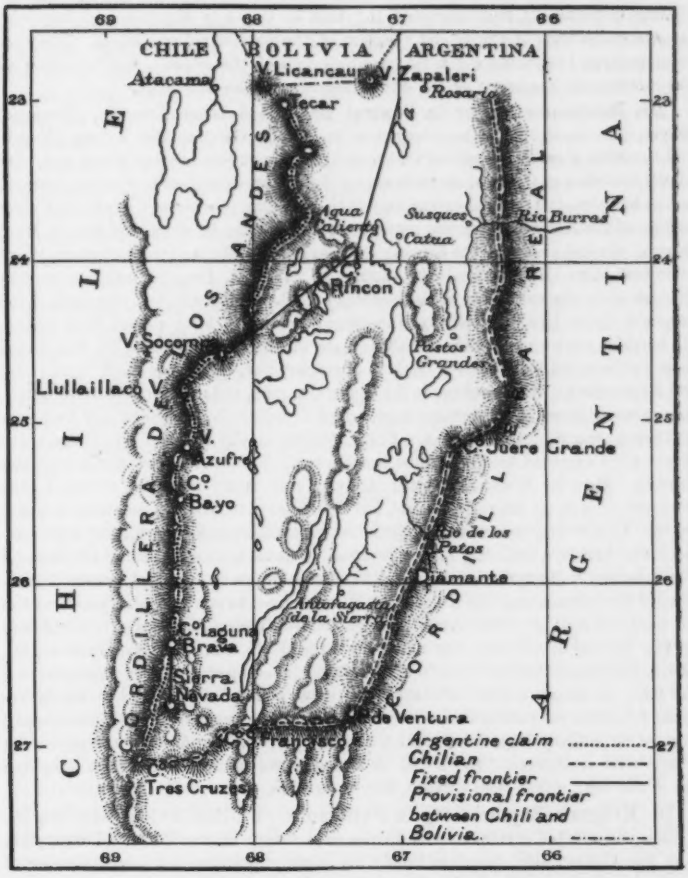
AMERICA.

Twelfth Census of the United States.—The arrangements made for the taking next year of the twelfth census of the United States are summarized in the *Bulletin* of the American Geographical Society (No. 2, 1899). The Director will be Mr. W. R. Merriam, of Minnesota, while the services of Messrs. Wines and Gannett, who took part in both the tenth and eleventh censuses, have again been secured. The other co-operators include Prof. Willcox, of Cornell University, who will ultimately devote his attention largely to the discussion of results and their presentation in form most useful to scientific men. Elaborate plans have been made for the execution of the enumeration, which will be carried out by an army of over 30,000 officials. Operations will begin in June, 1900, and the enumeration must be completed for the cities within two weeks, and for the county within thirty days, while the volumes must, according to the Act of Congress, be published within two years, so that the utmost efficiency on the part of the staff will be necessary. Probably over 3000 clerks will be employed at Washington.

Alaskan Exploration.—We learn from the *Bulletin* of the American Geographical Society (No. 2, 1899) that the scientific exploration of Alaska is being resumed this season, two parties having been sent out for the purpose. The one consists of Messrs. Peters and Brooks (as topographer and geologist respectively), who were to travel north-west along the base of the St. Elias range to the headwaters of the Copper river and Tanana, connecting their work with that effected last year. The other, consisting of Messrs. Schrader and Gerdine, hoped to explore the Koyukuk and other streams north of the Yukon.

The Argentine-Chilean Boundary in the Puna of Atacama.—In the boundary agreement of 1896 between Chile and Argentina, a distinction was made between the portions of the line north and south, respectively, of 26° 52′ 45″, the final decision south of that parallel being referred to Her Majesty's Government, while to the north, as far as 23°, the question was placed on a different footing, the concurrence of Bolivia being requisite. Between 23° and 26° 52′ 45″ the Argentine claim embraced all the country as far west as the high main chain of the Andes, considerably west of Zapaleri, on the provisional Bolivian-Chilean boundary of 1896. Chile, on the other hand, claimed the whole tract between the main Cordillera and the continuation of the Cordillera Real of Bolivia, the proposed line turning sharply to the west at the Pato de Ventura, towards the pass of San Francisco and Mount Tres Cruzes. The attempts of the Commissioners to arrive at an agreement proving unsuccessful, the decision was placed in the hands of Mr. Wm. Buchanan, U.S. Minister in Argentina, with one representative of either country. The decision was given last spring, and resulted in assigning to Argentina the greater part of the contested territory. The boundary-line is fixed as running through a large number of summits and other points in the neighbourhood of the main Cordillera, starting from the intersection of the 23rd parallel with the 67th meridian, the principal points mentioned being the Cerro de Rincon, the Volcano Socompa, Mount Llullaillaco, the volcano Azufre or Lastarria, and Mount Aguas Blancas. The last point fixed towards the south is the summit of the Sierra Nevada, as shown on the Argentine map, with the altitude of 6400 metres. From this point a straight line will be drawn to that point on the parallel of 26° 52′ 45″, which shall eventually be fixed by Her Majesty's Government. The country lying between the two Cordilleras, which has been the subject of the recent difficulty, is a high plateau with large salt lakes and numerous volcanoes, some still active, and possessing mines of gold, silver, copper, and nickel, as well as alluvial gold. Borax is also obtained.

The pastures are poor, and small numbers of llamas, goats, sheep, and mules are reared at a few places only.



THE NORTHERN ARGENTINE-CHILEAN BOUNDARY.

Re-measurement of the Arc of the Meridian of Quito.—At the International Geodetic Conference held at Stuttgart last year, it was laid down as desirable, at the instance of the American delegate, that the measurement of the equatorial arc of the meridian, in the neighbourhood of Quito, carried out last century by MM. Bouguer, La Condamine, and Godin, should be revised with the greatest accuracy possible by the help of modern methods. The idea has been taken up warmly in France, and a Committee appointed to consider the question resolved last January to recommend the project to the consideration of Government, suggesting as desirable the measurement of an arc of 5° to 6°, so that the result might

admit of comparison with similar operations, now being carried out in the Old World. The despatch of a preliminary expedition was recommended, and on May 15 last the announcement was made to the Paris Academy of Sciences that the French Government had entrusted the task to Captains Maurain and Lacombe, experienced officers of the geodetic section of the Service Géographique. They are commissioned to execute a general reconnaissance of the ground, and to collect all the information necessary for the due prosecution of the enterprise.

Dr. Herrmann Meyer in Central Brazil.—A letter from Dr. Herrmann Meyer, printed in the *Verhandlungen* of the Berlin Geographical Society (Nos. 5. and 6, 1899), gives an account of that traveller's movements down to March last. Dr. Meyer was then at Cuyaba, about to set out for the more serious part of his journey, but he had already travelled extensively in the southern provinces of Brazil, and gives useful information regarding the present state of affairs in them and also in Mato Grosso. He had visited all the German colonies in the south, and reached the military colony of Alto Uruguay and the district of Misiones, forming satisfactory conclusions as to the suitability of the country for colonization and the prospects of the proposed upper Uruguay railway, the surveys for which have already been begun. He had also paid a visit to the Details Indians on the Rio de Varzea, but found that they had retained little of their original character, having become much mixed with the Negro stock. At Nonohay, on the upper Uruguay, and in several other localities, there are settlements of the same race, which is said to be related to the Caingang of Parana and Santa Catharina. From Pelotas, in the south of Rio Grande, Dr. Meyer went overland to Montevideo, and then *viâ* Buenos Aires to Diamantino and Cuyaba. Here he found that much activity had lately prevailed owing to the attempts to open up the rubber trade, but several expeditions had met with disaster. Captain Duarte and several companions had succumbed to fever while on a journey down the Arinos, a tributary of the Tapajos. Colonel Castro had sought in vain for the legendary "Martyrios" mines, but had been shown a supposed ancient burial-place of the Indians near the Kul sehu. He was about to start anew in search of the old mines of Arayes. Two Americans, named Williamson, had gone to the Xingu by the Kulisehu, but had not since been heard of; while, lastly, an Italian, Dr. Pasini, had descended the Arinos and Tapajos in company with a surveyor, and had made an accurate chart of those rivers down to the Salto Augusto. Dr. Meyer hoped to obtain for publication some account of their journey. He had been already engaged on anthropological researches, and his preparations for his journey to the Xingu were completed. He hoped to announce its successful termination by the end of the year, either from Cuyaba, Goyaz, or Para.

Dr. Krüger's Explorations in Patagonia.—Dr. Paul Krüger, who, like Dr. Steffen, has devoted several seasons to the exploration of the Andes of Patagonia from the Chilian side, describes briefly his latest expedition in a recent number of the *Verhandlungen* of the Berlin Geographical Society (1899, Nos. 5 and 6). It will be remembered that for some time past a problem has existed as to the ultimate destination of the Futaleufu, a stream which occupies an important longitudinal valley in the portion of the Cordillera cut by the 43rd parallel of south latitude. Dr. Krüger's exploration of the Corcovado in 1898 proved that the latter stream has no connection with the Futaleufu, as had before been thought probable. On the other hand, it had been suggested, though Dr. Krüger did not share the opinion, that the Futaleufu joined the Palena. This uncertainty has been set at rest by Dr. Krüger's latest expedition, on which he spent some six months during the season of 1898–99. He directed his attention to the Rio Yelcho, the importance of which he had for the first time demonstrated during the previous year. Its mouth is in 42° 54′ S. lat., where it forms a large delta with many channels, of which the

southernmost is the chief. The stream was ascended in a cutter and two rowing-boats, and proved more easily navigable than is usually the case with Patagonian rivers. For the first 30 miles, during which it came from the south-east, it had the character of a forest stream with clear green water, and a breadth of from 150 to over 300 yards. Its valley is comparatively narrow, but the ground on both sides presents facilities for road-making. On the north a wooded plain extends for some distance. On December 2 Dr. Krüger reached a lake 15 miles long, formed by the river at an elevation of 200 feet. Its shores are so steep that it would be impossible to follow them by land. Beyond the lake the river was still navigable for a short space, the total distance traversed by boat being over 55 miles. Unlike many of the Patagonian rivers, it derives a comparatively small part of its volume from tributaries. In 43° 27′ S. a sudden change, both in the direction and character of the stream, takes place, as it there comes from the north-east and flows like a mountain torrent through a succession of narrows, progress through the forest on its banks being for a time excessively difficult. Subsequently the valley took an easterly direction, and it became possible to proceed in canvas boats, which were afterwards exchanged for wooden ones made by Dr. Krüger's men. The river was followed to the debouchure of the Corintos into the "Valley of the 16th October," and its identity with the Futaleufu was thus established. The journey has also disclosed a comparatively easy route from the sea to the colonies on the Futaleufu and its tributaries, while during further explorations in the district adjoining the upper Futaleufu, a good alternative route *viâ* the Renihue and Lake Barros Arana was shown to exist. After regaining the coast, Dr. Krüger was able to make some rectifications in the maps of the districts adjoining the mouth of the Yelcho.

POLAR REGIONS.

Peary's Arctic Expedition.—The Brooklyn *Standard Union* for July 15 contains a full account of the arrangements made by the Peary Arctic Club for the carrying of supplies to the explorer during the present summer, together with a hitherto unpublished narrative by Peary himself, of his voyage last summer from Sydney, C.B., to Etah in Foulke Fiord, on the eastern shore of Smith sound. The Peary Club expedition has been despatched in accordance with the explorer's instructions drawn up before his departure, and is under the leadership of Mr. Herbert L. Bridgman, a member of the Peary auxiliary expedition of 1894. The screw steamer *Diana*, Captain Samuel Bartlett master, has been secured for the voyage. The ship is regarded as one of the best of the St. John's sealing fleet, and was employed by the Canadian Government in 1897 for the examination of the entrances to Hudson bay. Her captain belongs to the well-known Bartlett family of Newfoundland, being brother of Captain John Bartlett of the *Windward*, and of Captain Harry Bartlett who commanded the *Falcon* in the 1893–94 Peary expeditions. Ample supplies of provisions have been despatched in the *Diana*, which sailed from St. John's on July 15, and after calling at Disco and Upernavik, will proceed to Bowdoin bay, in Inglefield gulf, where intelligence of the explorer and his party will probably be obtained. Failing this the ship will proceed to Littleton island, and, in accordance with Peary's instructions, supplies will be left at one or other of these places. The members of the present expedition do not expect to meet Peary in person, as, if all has gone well, the latter should be at some far northern point; it is thought, however, that letters will have been sent back by the Eskimo, who on their return north will also carry despatches to the explorer. It is hoped that news may also be obtained of Captain Sverdrup's party in the *Fram*, and in view of this letters and newspapers have been transmitted from Norway to be carried by the

Diana. Three independent parties have accompanied the expedition, one under Prof. William Libbey for deep-sea scientific work, and one headed by Robert Stein of Washington, to spend one or two winters in Ellesmere Land, in addition to a party of sportsmen. Mr. Peary's account of last year's voyage states that, helped by favouring winds, the *Hope* reached the latitude of Cape Farewell on July 12, five days after leaving Sydney. On the 15th * the edge of the East Greenland ice was sighted. This was last year unusually wide and heavy, but it was at last successfully passed. Progress was again rapid until Melville bay was reached, when the ice again formed a serious obstacle. The *Hope* was nipped on one occasion, but finally, after great difficulties, Cape York was reached, where, however, the settlement was found deserted, as was also that in Parker Snow bay. The first natives were met on Saunders island, 70 miles from Cape York, and from them it was learnt that the winter had been long and cold, and the spring catch of walrus had been a complete failure. Fortunately, however, an abundant supply of dogs was available. After the arrival of the *Windward*, the two ships cruised between Whale sound, Hakluyt island, and Littleton island, obtaining some walrus, and finally separating at Etah, in Foulke fiord, the *Hope* going south, and the *Windward* north. Some 80 tons of coal were landed from the *Hope* for the *Windward*'s use on her return, while a depôt of provisions was to be made at Littleton island. Of the further experiences of the *Windward* nothing is yet known.

Mr. Wellman's Expedition.—According to a telegram from Tromsö, dated August 17, the steamship *Capella* arrived there that day with Mr. Walter Wellman and the survivors of his North Polar expedition. In the autumn of 1898, after reaching Franz Josef Land, it is stated, an outpost, called Fort McKinley, was established in lat. 81° (possibly in Wilczek Land), and a house was built of rocks roofed over with walrus hides. Here two men, Paul Bjoervig and Bernt Bentzen (who was with Nansen in the *Fram*), remained there during the winter. The main party wintered in a canvas-covered hut, named Harmsworth House, at Cape Tegetthoff, on Hall island, in lat. 80° N. In the middle of February, before the sun appeared, and in the depth of winter, Mr. Wellman, with three Norwegians and forty-five dogs, started north. On reaching Fort McKinley, they found that Bentzen had died two months before, but Bjoervig was well and cheerful. Pushing northwards through ice with severe storms and a temperature for ten days 40° to 50° below zero, it is stated that the party discovered new lands north of the Frenden (no doubt Frieden) islands (Nansen's Hvidtland). In the middle of March Mr. Wellman unfortunately fell into a crevasse and so severely injured his leg that the party had to retreat. Two days later, it is stated, an earthquake crushed many dogs and destroyed sledges. Had it not been for these misfortunes, it is stated, all hands were confident of reaching 87° or 88° N. Mr. Wellman had to be dragged in a sledge for 200 miles to headquarters, which were reached early in April. In subsequent sledge journeys, it is stated, the expedition explored unknown regions, and important scientific work was done by Dr. Hofmann, Lieut. Baldwin, and Mr. Hanlan. The *Capella* arrived at Cape Tegetthoff on July 27. On August 9 she met the Duke of Abruzzi's ship; all on board were well. No traces of Andrée were found in Franz Josef Land. It would seem from this summary that Mr. Wellman's journey was made up the last side of Franz Josef Land; but further details will be awaited with interest.

Drift-casks for the Determination of Arctic Currents.—The *Comptes*

* As the 15th is again mentioned later, this is possibly a misprint for 13th.

Rendus of the Paris Geographical Society (May, 1899) contains the announcement from San Francisco that the experiments with casks for the elucidation of the arctic currents, proposed by Commander Melville, are to be made under the auspices of the Philadelphia Geographical Society. The United States Government have agreed to co-operate, and fifty casks, specially constructed at San Francisco, will be set adrift in various parts of the Arctic ocean by the revenue cutter *Bear*, and by vessels of the Pacific Steam Whaling Co. and of the firm of Liebes and Co. Commander Melville's plan has already been described in the *Journal* (vol. xii. p. 194).

Russian Arctic Research.—The Russian Government has granted the sum of £6000 for the purchase of a ship for arctic exploration, for an expedition which is to be sent out for exploring the New Siberia islands and Sannikoff's Land under Baron Toll.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Eastern Margin of the North Atlantic Basin.—An instructive paper on this subject, by Mr. W. H. Hudleston, appears in the *Geological Magazine* for March and April of the present year. The feature to which especial attention is devoted by the writer is the "sub-oceanic continental slope," which constitutes the true eastern margin of the North Atlantic basin, and, running through 51° of latitude with a mean direction slightly west of the meridian of Greenwich, has a total length, including sinuosities, of no less than 5000 miles. This slope is described by the writer as performing a double function: in the first place, as the more or less abrupt termination of a continental mass, affording relief to the periodic strain, and becoming at times the seat of dynamic energies of great force; and in the second, containing all but the surface waters of the oceans within its limits. In presenting a general hydrographic description of the North Atlantic basin, Mr. Hudleston deals in turn with (1) the North Polar ocean and the Norwegian Atlantic; (2) the Icelandic shallows, due to volcanic extravasation, and forming a partial interruption of the great north-to-south depression; and (3) the British Atlantic and Bay of Biscay; the description in each case being followed by a consideration of the geological bearing of the facts. In laying stress on the linear arrangement of the North Atlantic oceanic depression, which since the voyage of the *Fram* is known to be continued northwards between Greenland and Spitsbergen into the North Polar basin, the writer touches on the great question of the permanence or non-permanence of the great features of the Earth's crust, showing the inconclusive nature of many of the arguments brought forward by supporters of the latter view, with whom the *onus probandi* may justly be considered to rest. Another point to which criticism is applied is the supposed existence of cañons and escarpments on the margin of the Bay of Biscay. The conclusions to be drawn from a study of the whole question are summed up at the end of the paper. The writer holds that the true eastern boundary of the North Atlantic basin is the submerged slope lying beyond the edge of the submerged platform; that the edge of the platform ranges from about 80 to 250 fathoms; that the sub-oceanic slope—the true limit between the continental and oceanic areas—may be traced more or less distinctly, though of unequal strength and interrupted by extensive basaltic eruptions, as far as the north-west of Spitsbergen, where the north-north-east trend becomes easterly in face of the North Polar ocean; and that local changes to the extent of 500 fathoms would still leave the great depths unaffected.

CORRESPONDENCE.

M. Dutreuil de Rhins in Central Asia.

Paris, 20 Boulevard des Invalides, Août 4, 1899.

MADAME RIJNHART, dont vous connaissez certainement le long et douloureux voyage dans le Tibet oriental, vient de m'écrire pour me faire part des renseignements qu'elle et son mari ont recueillis sur la triste affaire qui a amené la mort de Dutreuil de Rhins. Les témoignages de tous ceux que M. et Mme. Rijnhart ont interrogés concordent entièrement avec le récit que j'ai publié des événements en question. Personne ne connaissait rien, dit en propre termes ma correspondante, des faits racontés par le Dr. Hedin. Là dessus tout le monde est d'accord, le Chinois de Tong-kar, attaché comme interprète à l'expédition envoyée à Tongbou-mdo par le vice-roi du Chen-kan, le lama mongol qui sert d'interprète au fonctionnaire chinois que le Légat Impérial de Si-ning délègue de temps à autre à Gyé-rgoun-do, enfin d'une manière générale tous les Tibétains des environs de Gyé-rgoun-do bien placés pour savoir le détail des faits à cause de leur voisinage des lieux où Dutreuil de Rhins a péri. Le premier homme cité ci-dessus, dont M. et Mme Rijnhart avaient pu apprécier auparavant le caractère honorable, a été rencontré par eux à Barong-Tsadam, le second a été vu par Mme. Rijnhart seule à Gyé-rgoun-do même. Je ferai remarquer que le missionnaire hollandais et sa femme sont les seuls Européens qui, depuis notre propre voyage, aient pénétré assez près de l'endroit où notre caravane a été attaquée, les seuls aussi qui aient pu causer avec les indigènes sans le secours d'un interprète. D'ailleurs les témoignages qu'ils ont recueillis ne font que confirmer le résultat déjà acquis par l'enquête officielle chinoise.

Comme le Journal de votre Société s'est fait autrefois l'écho de bruits dont l'inexactitude est ainsi définitivement démontrée, j'ose compter, Monsieur, sur votre haute courtoisie pour insérer cette rectification sous la forme que vous jugerez convenable. Je n'entends pas plus polémiquer aujourd'hui sur cette vieille question que je ne l'ai fait autrefois, j'entends seulement constater des faits indiscutablement acquis.

F. GRENARD.

Bear Island.

On p. 55 of the July number of the *Geographical Journal* you publish a map of Bear island, made by the Swedish Polar Expedition of 1898. I desire to call attention to important mistakes in nomenclature which should be corrected.

In Purchas's account of Poole and Bennet's expedition of 1605, it is stated that they gave to the hill at the south of the island (the one whose slopes were climbed to call for help) the name Mount Misery. "Likewise," continues Poole, "there is a very high mountain on the E.S.E. point of this island, which, because Master Welden and I (J. Poole) got two foxes neere it, I called it Mount Maleperdus, alluding to the name in the merrie booke of Reinold the Foxe."

The Mount Misery of the new map and Admiralty chart I take to be Mount Maleperdus, whilst Mount Hamberg is the true Mount Misery.

MARTIN CONWAY.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1898–1899.

May 8, 1899.—The paper read at this meeting (see vol. xiii. p. 673) was "Travels in the Bolivian Andes." By Sir Martin Conway.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Lakes. *Rev. G. Italiana* **6** (1899): 420–421. **Halbfass.**

Dati morfometrici di alcuni laghi prealpini. Pel Dottore Guglielmo Halbfass.

Austria—Bosnia. *Deutsche G. Blätter* **22** (1899): 71–85. **Bräss.**

Jajec, die alte Königsstadt Bosniens. Von Dr. Martin Bräss.

Austria—Poland. ———

Akademia Umiejętności w Krakowie. Sprawozdanie Komisyi Fizyograficznej. T. xxxiii. w Krakowie, 1898. Size 9½ × 6, pp. xviii. 200, 212, and 46. *Presented by the Cracow Academy of Sciences.*

Austrian Alps. ———

Siebenter Jahres-Bericht des Sonnblick-Vereines für das Jahr 1898. Wien, 1899. Size 12 × 8, pp. 60. *Illustrations.*

This report contains articles on some ancient customs of the Austrian mountain people, a list of minerals found on the Sonnblick, and the results of recent meteorological observations on the mountain.

Azores. *C.Rd.* **128** (1899): 1471–1473. **Thoulet.**

Carte bathymétrique de l'archipel des Açores. Note de M. J. Thoulet.

Describes the additions made by the Prince of Monaco to our knowledge of the bed of the ocean round the Azores.

Balkan Peninsula. *Petermanns M.* **45** (1899): 97–106. **Mach.**

Beiträge zur Ethnographie der Balkanhalbinsel. Von Richard v. Mach. *With Maps.*

Belgium. **Lancaster.**

Le climat de la Belgique en 1897. Par A. Lancaster. Bruxelles, 1898. Size 7 × 5, pp. 202. *Map and Diagrams. Presented by the Author.*

Belgium. *B.S.R. Belge G.* **23** (1899): 136–144. **Rahir.**

Le Vallon des Chaudières (Bassin de l'Amblève). Par Edmond Rahir. *With Illustrations.*

Belgium—Canals. *P.I. Civil Engineers* **136** (1899): 282–306. **Vernon-Harcourt.**

The Brussels International Congress on Navigation of 1898; the Bruges Ship-Canal; and New Works at Ostend and Antwerp. By L. F. Vernon-Harcourt. *With Plans and Sections.*

Denmark—Oceanographical Observations. ———

Beretning fra Kommissionen for videnskabelig Undersøgelse af de danske Farvande. Andet Bind. Første Hefte. Ditto Andet Hefte. Kjøbenhavn, 1897–1899. Size 13 × 10, and 14 × 10½, pp. 32 and 80. *Diagrams. Presented by the Author.*

Europe—Maps. **Haardt v. Hartenthurn.**

M. k. u. k. Militär-G. I. **18**, 1898 (1899): 112–159.

Die militärisch wichtigsten Kartenwerke der europäischen Staaten. Von Vincenz Haardt von Hartenthurn. *With Maps.*

An account of the most important large-scale Government maps of the different countries of Europe.

Europe—Meteorology. *Met. Z.* **16** (1899): 241–256. **Kassner.**

Ueber die Bewölkung in Europa an Cyklonen- und Anticyklonen-Tagen. Von Dr. C. Kassner.

On the distribution of cloud over Europe in cyclonic and anticyclonic weather.

France. *Mém. S. Spéléologie* **3** (1898): 1–16. **Janet.**

L'Embut de Caussols (Alpes-Maritimes). Par M. Armand Janet. *With Plans and Illustration.*

France. **Leroux.**

Le Massif Central. Histoire d'une région de la France. Par Alfred Leroux. 3 vols. Paris: É. Bouillon, 1898. Size 10 × 6½, pp. (vol. i.) xxviii. and 432; (vol. ii.) 388; (vol. iii.) 312. *Price* 21*s.*

This historical study is based throughout on geographical conditions, and it brings out the control always exerted by the physical conditions of the region on the inhabitants and their industries.

France. **Reclus.**

Le Plus Beau Royaume sous le Ciel, Décrit par Onésime Reclus. Paris: Hachette et C^ie^, 1899. Size 9½ × 7, pp. 862. *Price* 9*s.*

A picturesquely written description of the geography of France, full of accurate detail happily applied to the elucidation of geographical principles. Although without maps or illustrations, the volume is a model of typographical grace, and there is an ample index.

France—Brittany. *P. Canadian I.* **2** (1899): 11–14. **Macallum.**

The Prehistoric Monuments of Brittany. By Prof. A. B. Macallum.

France—Isère. *Spelunca* **4** (1898): 115–122. **Mellier.**

Projet d'utilisation de la grotte de Goule-Noire (Isère). Par M. Étienne Mellier.

The proposal outlined in this paper is to utilize caverns as underground reservoirs, and so store up and employ to the best advantage the rainfall of the district.

France—Jura. *Spelunca* **4** (1898): 109–115. **Fournier.**

Note préliminaire sur quelques explorations spéléologiques dans le Jura. Par M. E. Fournier.

France—Savoy. *Deutsche Rundschau G.* **21** (1899): 385–402. **Mader.**

Auf den Mounier. Von Dr. Fr. Mader. *With Illustrations.*

Germany—Gravity. **Haasemann.**

Veröffentlichung des Königl. Preussischen Geodätischen Institutes. Bestimmung der Intensität der Schwerkraft auf fünf und fünfzig Stationen von Hadersleben bis Koburg und in der Umgebung von Göttingen. Bearbeitet von L. Haasemann. Berlin: P. Stankiewicz. 1899. Size 10 × 7½, pp. 96. *Plates.*

Holland—Bibliography. **Thorne.**

Reading List on the Netherlands. By Elisabeth Gertrude Thorne.—University of the State of New York, State Library Bulletin. Bibliography No. 9. April, 1898. Albany, 1898. Size 10 × 7, pp. 185–207.

Iceland. **Thoroddsen.**

Explorations in Iceland during the years 1881–98. By Dr. Th. Thoroddsen. From the *Geographical Journal* for March and May, 1899. Size 10 × 6½, pp. 56. *Map and Illustrations.*

Italy—Apulia. *Riv. G. Italiana* **6** (1899): 81–93, 193–200, 271–283. **Bertacchi.**

Sulla Plastica e la Geologia della Regione Pugliese. Nota di Cosimo Bertacchi.

Italy—Sicily. *Riv. G. Italiana* **6** (1899): 284–290. **Marinelli.**

Spostamento della foce del Simeto (Sicilia). Nota di Olinto Marinelli. *With Sketch-map.*

On the changes in the position of the mouth of the river Simeto between 1867 and 1897.

Italy—Venice—Bibliography. **Sperry.**

Reading List on Venice. By Helen Sperry.—University of the State of New York. State Library Bulletin. Bibliography No. 7. February, 1898. Albany, 1898. Size 10 × 7, pp. 137–156.

Norway—Fisheries. *Rev. Scientifique* **11** (1899): 673–681. **Pérard.**

La pêche en Norvège. Par M. J. Pérard.

Russia. *Petermanns M.* **45** (1899): 129–146. **Immanuel.**

Der russische Norden und die Murman-Küste. Von Hauptmann Fr. Immanuel. *With Maps.*

Russia—Finland. *Blackwood's Mag.* **166** (1899): 1–15. ———

The Downfall of Finland: an Object-Lesson in Russian Aggression.

Russia—Finland. *Meddelanden G. Fören. Finland* **4** 1897–1898 (1899): 1–81. **Borg.**

Fysillis-maantieteellisiä tutkimuksia Kalvolan pitäjässä. Tehnyt Väinö Borg. *With Map and German Abstract.*

On the parish of Kalvola, in South-Western Finland, describing the orography, hydrography, vegetation, and population.

Russia—Finland. **Hammarström.**

Meddelanden G. Fören. Finland **4**, 1897–1898 (1899): 1–20.

Om Bötombergen. Af R. Hammarström. *With Sketch-map and German Abstract.*

On the Bötom mountains in the south of the province of Wasa.

Russia—Finland. **Hammarström.**

Meddelanden G. Fören. Finland **4**, 1897–1898 (1899): 1–32.

Ätsärinselkä och Välivesi sjöar. Af R. Hammarström. *With Map and German Abstract.*

On the survey of Lakes Ätsärinselkä and Välivesi, with bathymetrical map.

Russia—Finland. *Meddelanden G. Fören. Finland* **4**, 1897–1898 (1899): 1–34 **Häyrén.**

Granbestånden i Finland. Af A. E. Häyrén. *With Map and German Abstract.*

On the pine forests and pine-swamps of Finland and the associated undergrowths.

Russia—Finland. *Meddelanden G. Fören. Finland* **4**, 1897–1898 (1899): 1–13. **Hult.**

Finlands landryggar. Af R. Hult. *With German Abstract.*

On the insufficiency of the conventional representation of heights on maps to show the character of the land-ridges, which are the most conspicuous features of the configuration of Finland, and the advantage of using methods which will not give the appearance of a mountain range to every watershed.

Russia—Finland. *Meddelanden G. Fören. Finland* **4**, 1897–1898 (1899): 13–14. **Hult.**

Die Pflanzenregionen des finnländischen Lappmarken. Von R. Hult.

The original text in Swedish under the title, "Växtregionerna i Finlands lappmarker," was published in the previous number of the *Föreningen*, 1897, pp. 60–71.

Russia—Finland. *Meddelanden G. Fören. Finland* **4**, 1897–1898 (1899): 1–22. **Hult.**

Nyländska dalar. Af R. Hult. *With Map and German Abstract.*

On the valleys of Nyland, in Southern Finland.

Russia—Finland. *Meddelanden G. Fören. Finland* **4**, 1897–1898 (1899): 1–3. **Rosberg.**
Dynerna på Tauvonsaari. Af J. E. Rosberg. *With Map.*
On the sand-dunes of the Tauvonsaari peninsula.

Russia—Finland. *Meddelanden G. Fören. Finland* **4**, 1897–1898 (1899): 1–14. **Streng.**
Djupkarta öfver Lojo sjö. Västra hälften. Af A. E. Streng. *With Map and German Abstract.*
Bathymetrical map of the Lojo lake.

Russia—Finland. *Meddelanden G. Fören. Finland* **4**, 1897–1898 (1899): 1–29. **Thesleff.**
Zigenarnes utbredning i Finland. Af Arthur Thesleff. *With Map and German Abstract.*
On the distribution of gypsies in Finland.

Russia—Military Cartography. **Truck.**
M. k. u. k. Militär-G. I. **18**, 1898 (1899): 169–224.
Die Entwicklung der russischen Militär-Kartographie vom Ende des 18. Jahrhunderts bis zur Gegenwart. Nach officiellen Quellen bearbeitet von Sigismund Truck.

Sweden. ——
Svenska Turistföreningens Årsskrift för År 1899. Stockholm: Wahlström & Widstrand. Size 8½ × 5½, pp. viii. and 444. *Illustrations. Presented by the Svenska Turistföreningen.*

Turkey. *M. k. u. k. Militär-G. I.* **18**, 1898 (1899): 97–111. **Steeb.**
Der Ljubeten in der Sara Planina. Von Christian Ritter v. Steeb. *With Sketch-maps.*
On the survey of the mountain group of the Ljubeten.

United Kingdom—England. *Fortnightly Rev.* **66** (1899): 53–62. **Jacobs.**
The Mean Englishman. By Joseph Jacobs.
This is a demographic study intended to illustrate the character of the English people by that of an individual fulfilling the average conditions of the Englishman in every particular.

United Kingdom—England. *Quarterly J. Geolog. S.* **55** (1899): 129–169. **Groom.**
The Geological Structure of the Southern Malverns, and of the Adjacent District to the West. By Prof. T. T. Groom. *With Plates and Sections.*

United Kingdom—England—Education. **Hodgins.**
Report on Popular Education in England, 1897–98. By J. George Hodgins, M.A., LL.D. Being Appendix N of the Report of the Minister of Education for the Province of Ontario for the year 1897–98. Toronto, 1899. Size 10 × 6½, pp. 78.

United Kingdom—England. **Murray.**
A Handbook for Travellers in Somerset. Fifth Edition. London: John Murray, 1899. Size 7 × 4½, pp. xxxvi. and 536. *Maps and Plans. Price* 6*s. Presented by the Publisher.*
The county of Somerset has now been placed in a volume by itself. The descriptions have been brought up to date, due provision being made for the wants of cyclists, and the book is admirably supplied with clear large-scale maps.

United Kingdom—England. **Ward.**
Thorough Guide Series. The Eastern Counties, with a practical Section on the Rivers and Broads. By C. S. Ward, M.A. Twenty-one Maps and Plans, by J. Bartholomew. Fourth Edition—Revised. London: Dulau & Co., 1899. Size 6½ × 4½, pp. x. and 144. *Price* 3*s.* 6*d. Presented by the Publishers.*

United Kingdom—Erratic Blocks. *Brit. Assoc. Rep.* (1898): 552–556. ——
Erratic Blocks of the British Isles. Report of the Committee.

United Kingdom—Ethnographical Survey. *Brit. Assoc. Rep.* (1899): 712–714. ——
Ethnographical Survey of the United Kingdom.—Sixth Report of the Committee.

United Kingdom—Geology. *Brit. Assoc. Rep.* (1898): 530–546. ——
Photographs of Geological Interest in the United Kingdom.—Ninth Report of the Committee.
The collection of photographs of geological interest amounted at the date of this report to 2001.

United Kingdom—Ireland. *P. R. Irish A.* 5 (1899): 223–268. **Browne.**

The Ethnography of Garumna and Lettermullen, in the County Galway. By Charles R. Browne, M.D. *With Plates.*

United Kingdom—Ireland. *T.R. Irish A.* 31 (1899): 209–344. **Macalister.**

On an Ancient Settlement in the South-West of the Barony of Corkaguiney, County of Kerry. By R. A. Stewart Macalister. *With Map and Plates.*

A detailed description of a series of ancient buildings, hitherto very imperfectly described, with observations on their probable nature and origin.

United Kingdom—Ireland. *P.R. Irish A.* 5 (1899): 294–311. **Westropp.**

A List of the Round Towers of Ireland, with Notes on those which have been Demolished, and on four in the County of Mayo. By Thomas J. Westropp, M.A.

United Kingdom—Meteorology.

Report of the Meteorological Council for the year ending March 31, 1898, to the President and Council of the Royal Society. London: Eyre & Spottiswoode, 1898. Size 10 × 6½, pp. 140. *Map and Plans. Price* 11*d. Presented by the Meteorological Office.*

United Kingdom—Mines and Quarries.

Mines and Quarries: General Report and Statistics for 1898. Part i.—District Statistics. Statistics of the Persons employed, output, and accidents at Mines and Quarries in the United Kingdom, arranged according to the Inspection Districts. London: Eyre and Spottiswoode, 1899. Size 13 × 8½, pp. 46. *Maps. Price* 8*d. Presented by the Home Office.*

The total number of people employed in mines in 1898 was 741,125, and in quarries 134,478. The output of coal for the year was 202,054,516 tons, and that of iron-ore 14,176,938 tons. Fatal accidents in mines caused 941 deaths, and in quarries 134. The output of coal showed an increase in all districts except South Wales and South-Western England, where the decrease was so great as to give a net decrease for the year of 75,000 tons.

United Kingdom—Scenery. **Marr.**

The Development of British Scenery. By John E. Marr, F.R.S. [Reprinted from *Science Progress*, vol. vii. (vol. ii. of New Series), No. 8, July, 1898.] London: The Scientific Press, 1898. Size 10 × 6½, pp. 12. *Presented by the Author.*

On the scientific study of the forms of the land.

United Kingdom—Scotland. **Morris.**

The Geography of the Forth Valley. By David B. Morris. Read to the Stirling Natural History and Archæological Society, January 17, 1899. (Reprinted from the *Stirling Journal and Advertiser.*) 1899. Size 7 × 5, pp. 18. *Presented by the Author.*

An endeavour to give a geographical account of the valley of the Forth, taking account of all departments of the science.

Western Europe—Sub-Oceanic Terraces. **Hull.**

On the Sub-Oceanic Terraces and River Valleys off the Coast of Western Europe. By Prof. Edward Hull, LL.D., etc. Being a paper read before the Victoria Institute, April 17, 1899. London: Victoria Institute, 1899. Size 8½ × 5½, pp. 22. *Charts and Sections. Presented by the Author.*

ASIA.

Arabia. **Landberg.**

Arabica. Par le Comte de Landberg. No. V. Leide: E. J. Brill, 1898. Size 9½ × 6½, pp. xii. and 320. *Presented by the Author.*

Describes the following regions of Southern Arabia, Beyhan el-Qusab, Beyhan el-Asfal, Harib, the Wahidi country, Gerdan, and Sabwa.

Arabia. **Müller.**

Die Südarabische Expedition der Kaiserlichen Akademie der Wissenschaften in Wien und die Demission des Grafen Carlo Landberg. Actenmässig dargestellt von Dr. D. H. Müller. Wien und Leipzig: W. Braumüller, 1899. Size 10 × 6½, pp. 62. *Presented by the Publisher.*

This is Dr. Müller's reply to Count Landberg's account of the recent Austro-Hungarian Arabian expedition, and presents his view of the case.

Arabia—Mecca. *T.R.S. Literature* **20** (1899): 197–235. **Burton.**

Burton's Pilgrimage to Mecca: an Unpublished MS. of the late Sir Richard F. Burton, F.R.S.L. With an Introduction by W. H. Wilkins, M.A.

Central Asia. *G. Tidskrift* **15** (1899): 14–22. **Olufsen.**

Den anden danske Pamir expeditions Vinterstation 1898–99. Ved Premierløjtnant Olufsen. *With a Sketch-map.*

Central Asia. **Trotter.**

The Proceedings of the Pamir Boundary Commission. By Lieut.-Colonel Henry Trotter. From the *Geographical Journal* for April, 1899. Size 10 × 6½, pp. 8.

China. *Blackwood's Mag.* **165** (1899): 1069–1077. ——

Wei-hai-wei: Its Value as a Naval Station.

China. **Beresford.**

The Break-Up of China, with an Account of its Present Commerce, Currency, Waterways, Armies, Railways, Politics, and Future Prospects. By Lord Charles Beresford. London and New York: Harper & Bros., 1899. Size 9 × 6, pp. xviii. and 510. *Maps. Price* 12*s.*

Lord Charles Beresford was in China from September 30, 1898, to January 9, 1899. He visited all the British mercantile communities in China, and interrogated the merchants and others as to the condition of the country. He also inspected the Chinese army, navy, and the forts and arsenals. The journey was carried out for the Associated Chambers of Commerce in London.

China. **Chevalier.**

Observatoire de Zi-ka-wei. La Navigation à Vapeur sur le Haut Yang-tse. Par le R. P. S. Chevalier, S.J. Chang-hai: Kelly & Walsh, 1899. Size 13 × 10, pp. 14. *Maps. Presented by the Observatory of Zi-ka-wei.*

China. **Gorst.**

China. By Harold E. Gorst. London: Sands & Co., 1899. Size 9 × 6, pp. xx. and 300. *Map and Illustrations. Price* 6*s.*

On the economic resources of China, and the present political and commercial conditions of the country.

China. *Fortnightly Rev.* **66** (1899): 37–52. **Gundry.**

China: Spheres of Interest, and the Open Door. By R. S. Gundry.

China. *S.G., Tōkyō G.S.* **10** (1898): 583–592, 637–641. **Kinosuke.**

A Travel along the Minkiang, Fukien Province, China. By Kinosuke, Mouye. [In Japanese.]

China. **Little.**

Intimate China. The Chinese as I have seen them. By Mrs. Archibald Little. London: Hutchinson & Co., 1899. Size 10 × 7, pp. xvi. and 616. *Map and Illustrations. Price* 21*s.*

This book gives an epitome of the author's experience in China, especially with reference to the domestic life and customs of the Chinese.

China—Formosa. *Z. Ges. Erdk. Berlin* **34** (1899): 63–74. **Kakyo.**

Die wilden Stämme von Formosa, ihre Einteilung und ihr Kulturzustand. Von Ino Kakyo. Uebersetzung eines in japanischer Sprache geschriebenen Berichtes. *With Map.*

Chinese Geography. **Schlegel.**

Geographical Notes. VI. Ma-it—Ma-it-tung—Ma-iëp-ung. By G. Schlegel (pp. 22). VII. Tun-sun or Tian-sun, Tĕnasserim or Tānah-sāri. VIII. Pa-hoang, Pang-k'ang, Pang-hang, Pahang or Panggang. IX. Dziu Hut, Djohor (Johore). By G. Schlegel (pp. 22). X. To-ho-lo or Tok-ho-lo, Takōla or Takkōla. XI. Halotan or Kĕlantan, Kalatan or Kĕlantan. By G. Schlegel (pp. 12). Leyden: E. J. Brill, 1899. Size 10 × 6½. *Presented by the Author.*

India. *J.S. Arts* **47** (1899): 575–590. **O'Dwyer.**

Agrarian Conditions under British and Native Rule: a comparison of the Revenue Systems of British-India and Rajputana. By Michael Francis O'Dwyer.

India—Calcutta. *J.S. Arts* **47** (1899): 628–652. **Stevens.**

The Port of Calcutta. By Sir Charles Cecil Stevens, K.C.S.I.

India—Historical. *Indian Antiquary* **28** (1899): 1–6. **Abbott.**

The Topographical List of the Bhagavata Purana. By Rev. J. E. Abbott, B.A.

India—Survey Report. **Strahan.**

General Report on the Operations of the Survey of India Department administered under the Government of India during 1897–98. Prepared under the direction of Major-General C. Strahan. Calcutta, 1899. Size 13½ × 8½, pp. vi., 98, and lx. *Maps and Plates. Presented by the Surveyor-General of India.*

Japan—Bibliography. **Gay.**

Reading List on Japan. By Helen Kilduff Gay. University of the State of New York. State Library Bulletin, Bibliography No. 6, February, 1898. Albany, 1898. Size 10 × 7, pp. 121–135.

Japan—Proverbs. **Ehmann.**

Die Sprichwörter und bildlichen Ausdrücke der Japanischen Sprache. Gesammelt, Uebersetzt und Erklärt von P. Ehmann. Theil V. (von *Tanshi* bis *Zukan*), nebst Nachtrag. Supplement der "Mittheilungen" der Deutschen Gesellschaft für Natur- und Völkerkunde Ostasiens. Tokyo, 1898. Size 9 × 6, pp. 321–428.

Malay Archipelago—Sumatra. *Globus* **75** (1899): 318–325. **Volz.**

Hausbau und Dorfanlage bei den Battakern in Nordsumatra. Von Privatdocent Dr. Wilhelm Volz. *With Illustrations.*

Persia. **Reclus.**

La Perse. Par Élisée Reclus. Extrait du 'Bulletin de la Société neuchâteloise de Géographie,' tome xi., 1899. Neuchatel, 1899. Size 9 × 6½, pp. 40. *Maps. Presented by the Author.*

Philippine Islands. *Sitzb. A.W. Berlin* (1899): 14–26. **Virchow.**

Die Bevölkerung der Philippinen. Von Rud. Virchow. Zweite Mittheilung. *With Illustrations.*

Philippine Islands—Cyclones. **Algué.**

Observatorio de Manila. Baguios ó Ciclones Filipinos. Estudio teórico—práctico por el P. José Algué S. J. Manila, 1897. Size 10½ × 7½, pp. xii. and 308. *Diagrams. Presented by the Manila Observatory.*

On the paths pursued by the cyclones or typhoons passing over the Philippine Islands, with instructions for forecasting storms.

Portuguese India. *B.S.G. Lisboa* **16** (1897): 569–648. **Fernandes.**

Memoria historico-economica das alfandegas do estado da India portugueza. Por Francisco Xavier Ernesto Fernandes.

Russia—Caucasia. *Rev. G.* **44** (1899): 241–275, 340–358. **Baye.**

Au sud de la chaîne du Caucase. Souvenirs d'une mission. Par Baron de Baye. *With Illustrations.*

Russia—Caucasus. *Scottish G. Mag.* **15** (1899): 281–308. **Dingelstedt.**

The Hydrography of the Caucasus. By Victor Dingelstedt. *With Maps and Illustrations.*

The map shows the distribution of forests, grassy steppes with cultivated land, steppes, swamps, and mountain flora for the whole province of the Caucasus.

Russia—Caucasus. **Stevens.**

Trade of Batoum and District for the year 1898. Foreign Office, Annual No. 2254, 1899. Size 10 × 6½, pp. 28. *Price* 2*d.*

Russia—Siberia. *Travel* **4** (1899): 26–29. **Barrett-Hamilton.**

Glimpses of Life in the Far North-East. An Account of a Visit to Ukinsk Bay, North-Eastern Kamchatka. From Notes read at the Meeting of the British Association in September, 1898. By G. E. H. Barrett-Hamilton. *With Illustrations.*

Russia—Siberia. *G.Z.* **5** (1899): 326–346. **Immanuel.**

Die Gebirge Nordsibiriens. Von Hauptmann Immanuel. *With Map.*

Russia—Siberia. **Studnicki.**

Die Wahrheit über Sibirien. Studien nach der Natur, von Ladislaus Studnicki. Berlin: J. Räde, 1899. Size 8 × 5½, pp. x. and 162. *Price* 3*s.*

The author was born in Siberia, and spent the greater part of his life there. He treats of the position, climate, agriculture, land-tenure, economic development, crime, and colonization.

Russian Central Asia. *G.Z.* 5 (1899): 241–251. **Boehm.**

Reiseskizzen aus Transkaspien. Von Georg Boehm.

Russian Central Asia. **Skrine and Ross.**

The Heart of Asia. A History of Russian Turkestan and the Central Asian Khanates from the Earliest Times. By Francis Henry Skrine and Edward Denison Ross, PH.D London: Methuen & Co., 1899. Size 8½ × 6, pp. xii. and 444. *Maps and Illustrations. Price* 10*s.* 6*d. Presented by the Publishers.*

The first half of this important work is a concise history of Central Asia from the earliest times to the Russian occupation. The second half deals with the recent progress of the Russian advance, and there are two short appendices on Russian policy in Central Asia.

Turkey—Syria. *Globus* 75 (1899): 339–340. ———

Gebel Sēs in der Harra und seine Ruinen. *With Map and Illustration.*

AFRICA.

Africa. *Imp. and Asiatic Quarterly Rev.* 7 (1899): 129–134. **Seton.**

Britain in Africa—a Forecast. By Malcolm Seton.

Africa—Travel. *Rev. Française* 24 (1899): 321–327. **Demanche.**

Le Retour de Marchand: Chronologie de l'expédition. Par G. Demanche.

Algeria. *Scottish G. Mag.* 15 (1899): 361–365. ———

The Western Erg of Algeria.

Algeria. *Ann. G.* 8 (1899): 366–369. **Besnier.**

Notes sur l'Aurès: la plaine d'Arris. Par M. M. Besnier. *With Plates.*

Algeria—Sahara. *Rev. Française* 24 (1899): 328–331. **Foureau and Lamy.**

Sahara: La marche de la mission Foureau-Lamy. III. *With Map and Profile.*

Algeria—Sahara. *Questions Dipl. et Colon.* 7 (1899): 129–145. **Kryszanowski.**

La Pénétration du Sahara par l'Algérie, et la Mission Foureau-Lamy. Par L. Kryszanowski. *With Map.*

Congo State. *B.S.R.G. d'Anvers* 23 (1899): 39–76. **Van den Plas.**

Le Mayumbe. Par M. J. Van den Plas.

Congo State. *Mouvement G.* 16 (1899): 226–227. **[Wauters.]**

Carte de la haute Sanga et du territoire concédé à la Compagnie Sud-Kamerun. *With Map.*

Egypt. *Fortnightly Rev.* 65 (1899): 931–942. **Whittle.**

Egypt after Omdurman. By J. Lowry Whittle.

Egypt—Historical. *Abh. A.W. Berlin* (1898): 1–20. **Virchow.**

Ueber die ethnologische Stellung der præ-historischen und protohistorischen Aegypter. Von R. Virchow. *With Plates.*

Egypt—Nile Valley. *Ann. G.* 8 (1899): 242–251. **Brunhes.**

Les grands travaux en cours d'exécution dans la vallée du Nil. Par M. J. Brunhes. *With Map and Plates.*

Egypt—Suez Canal. ———

Commercial. No. 4 (1899). Suez Canal. Returns of Shipping and Tonnage, 1896, 1897, and 1898. London: Eyre and Spottiswoode, 1899. Size 13½ × 8½, pp. 10. *Price* 1½*d.*

In 1899 the number of vessels passing through the Suez canal was 3503, of which 2295 carried the British flag. British ships amounted to 65·2 per cent. in number, and their tonnage was 68·2 per cent. of all that passing through the canal.

Egyptian Sudan. *Scottish G. Mag.* 15 (1899): 80–86, 138–142, 309–316. **Capenny.**

The Khedivic Possessions in the Basin of the Upper Ubangi. By S. H. F. Capenny.

Egyptian Sudan. **Garstin.**

Egypt. No. 5 (1899). Despatches from Her Majesty's Agent and Consul-General at Cairo, inclosing a Report on the Soudan, by Sir William Garstin, K.C.M.G. London: Eyre & Spottiswoode, 1899. Size 13½ × 8½, pp. 28. *Price* 3*d.*

French Africa. *Rev. Française* **24** (1899): 296–299. ——

La Convention Franco-Anglaise du 21 Mars 1899. *With Map.*

The map shows very clearly the extent and limits of French territory in Africa.

French Congo. ——

Renseignements Colon., Comité l'Afrique Française **5** (1899): 73–88.

L'organisation du Congo français: décrets sur le régime foncier, les concessions et le régime forestier de la colonie.

French Sahara. *Questions Dipl. et Colon.* **7** (1899): 10–19. **Bernard.**

La Question du Transsaharien. Par Prof. Augustin Bernard.

A copy of the same paper, separately printed, has been presented by the Author.

French West Africa. *A travers le Monde, Tour du Monde* **5** (1899): 177–180. ——

Impressions du Fouta-Djalon. *With Illustrations.*

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This is an interesting history of instruments used in mine-surveying from an early time, and is illustrated by a series of pictures of theodolites and other appliances of different periods and different countries.

Time-measurement. *C. Rd.* **128** (1899): 1137–1142. **Lippmann.**

Sur la mesure absolue du temps, déduite des lois de l'attraction universelle. Note de M. G. Lippmann.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Atmospheric Electricity. **McAdie and Henry.**

Lightning and the Electricity of the Air. In two parts. Prepared by Alexander G. McAdie and Alfred J. Henry. U.S. Department of Agriculture, Weather Bureau. Bulletin No. 26. Washington, 1899. Size 9 × 6, pp. 74. *Map and Illustrations.*

Aurora. *Bihang K. Svensk. Vet.-A. Handlingar* **24** (1899): 1-18. **Bohlin.**

Ueber eine sonderbare am 2 Januar 1897 beobachtete Nordlichterscheinung. Von Karl Bohlin. *With Plates.*

Coast-lines. *P. American A. Arts and Sci.* **34** (1899): 151–258. **Gulliver.**

Shoreline Topography. By F. P. Gulliver. *With Maps.*

Geomorphology. **Davis.**

The Peneplain. By W. M. Davis. From the *American Geologist,* vol. xxii., April, 1899. Size 9½ × 6½, pp. 207–239. *Plate.*

A reply to Prof. Tarr's criticism of Prof. Davis's views on the origin of plains of sub-aerial erosion.

Meteorology of the Oceans. *Ann. Hydrographie* **27** (1899): 255–261. **Köppen.**

Ist die Veröffentlichung von Einzelbeobachtungen vom Ozean anzustreben? Von Dr. W. Köppen.

On the value of the meteorological observations made on board individual ships.

Meteorology—Temperature. **Satke.**
Nova Acta, Abh. K. Leop.-Carol. Deutsch. A. Naturforscher 71 (1897): 103–206.
Ueber den Zusammenhang der Temperatur aufeinander folgender Monate und Jahreszeiten. Von L. Satke.

Meteorology—Upper Air. *Rep. Smithsonian I.*, 1897 (1898): 301–316. **Graffigny.**
Explorations of the Upper Atmosphere. By Henri de Graffigny. *With Diagrams.*

Meteorology—Upper Air. **Marvin.**
The Use of Kites in the Exploration of the Upper Air. By C. F. Marvin. Yearbook of the U.S. Department of Agriculture, 1898. Washington, 1899. Pp. 201–212. *Illustrations.*

Meteorology—Upper Air. *Rep. Smithsonian I.*, 1897 (1898): 317–324. **Rotch.**
The Exploration of the Free Air by means of Kites at Blue Hill Observatory, Massachusetts. By A. Lawrence Rotch. *With Plates.*

Meteorology—Water-spouts. **Russell.**
Water-spouts on the Coast of New South Wales. By H. C. Russell. [Read before the Royal Society of N. S. Wales, August 3, 1898.] Size 9 × 6, pp. 18. *Plates. Presented by the Author.*

Meteorology—Wind. *Meteorolog. Z.*, 16 (1899): 204–215. **Billwiller.**
Ueber verschiedene Entstehungsarten und Erscheinungsformen des Föhns. Von R. Billwiller.

Oceanographical Museum. *Rev. Scientifique* 11 (1899): 591–593. ———
Le Musée océanographique de Monaco.

Oceanography. *Sitzb. A.W. Berlin* (1899): 384–400. **Lohmann.**
Untersuchungen über den Auftrieb der Strasse von Messina mit besonderer Berücksichtigung der Appendicularien und Challengerien. Von Dr. H. Lohmann.

Oceanography. *G.Z.* 5 (1899): 190–209, 252–260. **Natterer.**
Chemisch-geologische Tiefsee-Forschung. (Expeditionen der Schiffe "Pola" und "Taurus" in das östliche Mittelmeer, Marmara-Meer und Rote-Meer.) Von Dr. Konrad Natterer. *With Chart.*

Oceanography. *Ann. Hydrographie* 27 (1899): 227–236. **Schott.**
Von der deutschen Tiefsee-Expedition. Nach dem Bericht des Ozeanographen der Expedition Dr. Gerhard Schott. *With Chart.*

Plant-Geography. *Ann. G.* 8 (1899): 193–206. **Flahault.**
La géographie des plantes avec la physiologie pour base. Par M. Ch. Flahault.

River-temperature. **Barnes**
On some Measurements of the Temperature of the Lachine Rapids. By Howard T. Barnes, McGill University. Papers from the Department of Physics. No. 8. (Reprinted from the *Transactions of the Royal Society for Canada*, 1897, Section iii., pp. 17–30.) Montreal, 1898. Size 10 × 6½.

The observations were made by means of platinum resistance thermometers, and directly compared the open river-water of the rapids with a standard mixture of snow and river water, which allowed of readings being taken to one-thousandth of a degree. The water was found never to fall below the freezing point to as much as one-hundredth of a degree, but usually remained about three hundredths of a degree Centigrade above.

Seismology. *Brit. Assoc. Rep.* (1898): 179–276. **Milne and others.**
Seismological Investigations. Third Report of the Committee.

Speleology. *Abh. G. Ges. Wien* 1 (1899): 15–76. **Crammer.**
Eishöhlen- und Windröhren-Studien. Von Prof. Hans Crammer. *With Plans and Diagrams.*

Terrestrial Magnetism. *Brit. Assoc. Rep.* (1898): 80–136. **Ellis and Adams.**
Comparing and Reducing Magnetic Observations.—Report of the Committee. I. Magnetic Results at Greenwich and Kew Discussed and Compared, 1889 to 1896. By William Ellis, F.R.S. II. Account of the Late Prof. John Couch Adams's Determination of the Gaussian Magnetic Constants. By Prof. W. G. Adams, F.R.S.

Terrestrial Magnetism. **Fritsche.**
Die Elemente des Erdmagnetismus für die Epochen 1600, 1650, 1700, 1780, 1842 und 1885, und ihre Saecularen Aenderungen, berechnet mit Hülfe der aus allen

brauchbaren Beobachtungen abgeleiteten Coefficienten der Gaussichen "Allgemeinen Theorie des Erdmagnetismus" von Dr. H. Fritsche. St. Petersburg, 1899. Size 9 × 6½, pp. 112. *Presented by the Author.*

These tables are printed in facsimile of the author's MS.

Terrestrial Magnetism. *Sitzb. A. W. Berlin* (1899): 236–246. **Lüdeling.**

Ueber den täglichen Gang der erdmagnetischen Störungen an Polarstationen. Von Dr. G. Lüdeling. *With Plate.*

Terrestrial Magnetism. **Wild.**

Vierteljahrsb. Naturforsch. Ges. Zürich **43** (1898): 253–275.

Ueber die Bestimmung der erdmagnetischen Inklination und ihrer Variationen. Von H. Wild.

Zoogeography. **Grevé.**

Nova Acta, Abh. K. Leop.-Carol. Deutsch. A. Naturforscher **70** (1898): 289–377.

Die geographische Verbreitung der jetzt lebenden Perissodactyla, Lamnunguia und Artiodactyla non ruminantia. Von Carl Grevé. *With Maps.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

America—People. *Science* **9** (1899): 795–796. ——

Amerind—A Designation for the Aboriginal Tribes of the American Hemisphere.

A suggestion to introduce the term *Amerind* as a collective name for the Aborigines of America, the new word being obviously a contraction for "American Indian."

Colonization. *Quarterly Rev.* **190** (1899): 268–288. ——

Climate and Colonization.

Colonization. *Riv. G. Italiana* **6** (1899): 257–270, 345–356. **Ricchieri.**

Colonizzazione e Conquista. Dal Prof. Giuseppe Ricchieri.

Commercial Geography—Sugar. *J.R. Statistical S.* **62** (1899): 296–347. **Martineau.**

The Statistical Aspect of the Sugar Question. By George Martineau.

Studies the production of cane and beet sugar for twenty-five years, and especially discusses the production of beet sugar in France and Germany, Austria, Belgium and Holland, and Russia.

Commercial Geography—Wheat. *Brit. Assoc. Rep.* (1898): 3–38. **Crookes.**

Address by Sir William Crookes, F.R.S., President.

On the possibility of the exhaustion of the world's wheat-supply.

Historical—Ancient Altitudes. *Riv. G. Italiana* **6** (1899): 298–299. **Bertolini.**

Sulla determinazione delle altitudini presso gli antichi: a proposito dello scritto della signorina Bittanti. Nota del Prof. G. Lodovico Bertolini.

On the knowledge of the Latin writers as to the height of the Alps, a criticism of a previous paper.

Political Geography. *Nineteenth Century* **45** (1899): 991–1006. **Taylor.**

Sea-Power and Sea-Carriage. By Benjamin Taylor.

Political Geography—Cities. *Fortnightly Rev.* **65** (1899): 943–954. **Little.**

Two Cities: London and Peking. By Archibald Little.

On the historical development of London and Peking.

Primitive Houses. *Ann. G.* **8** (1899): 207–230. **Bertaux.**

Étude d'un type d'habitation primitive, Trulli, caselle et specchie des Pouilles. Par M. E. Bertaux. *With Map and Illustrations.*

BIOGRAPHY.

Heddle. *T. Edinburgh Geolog. S.* **7** (1899): 317–327. **Goodchild.**

Dr. Heddle and his Geological Work. By J. G. Goodchild. *With Portrait.*

Dr. Heddle, most distinguished by his geognostic researches, was one of the first to urge the importance of extending the geological survey to Scotland.

Leitner. *J.R. Asiatic S.* (1899): 725–729. ——

Dr. G. W. Leitner.

Manen. *Rev. Maritime* **141** (1899): 292–300. **Héraud.**

Léopold Manen, ingenieur hydrographe en chef de la marine (1829–1897). Par M. G. Héraud.

Simony. **Böhm.**

Zur Biographie Friedrich Simony's. Von Dr. August Böhm Edlen von Böhmersheim. Wien: R. Lechner (Wilh. Müller), 1899. Size 11 × 7½, pp. 62. *Presented by the Author.*

GENERAL.

Anglo-Jewish Association. ——

The Twenty-Eighth Annual Report of the Anglo-Jewish Association in connection with the Alliance Israélite Universelle, 1898-99. London, 1899. Size 8¼ × 5½, pp. 116. *Map. Presented by the Association.*

Art of Travel. *Rev. Scientifique* **12** (1899): 1–6. **Dybowski.**

Organisation d'un voyage d'exploration. Par M. Jean Dybowski.

Hints on equipment and organization for travelling in Africa, amongst which M. Dybowski gives precedence to the advice of an Arab chief, "Trust no one but yourself and your weapons."

Geography. *Rep. Smithsonian I.* 1897 (1898): 381–399. **Keltie.**

The Function and Field of Geography. By J. Scott Keltie, LL.D.

Jesup North Pacific Expedition. *Science* **9** (1899): 532–541. ——

Field-Work of the Jesup North Pacific Expedition in 1898.

This is noticed in the *Journal* for July, p. 96.

Malaria. **Grassi, Bignami, and Bastianelli.**

Atti R.A. Lincei, Rendiconti **8** (1899): 434–438.

Ulteriori ricerche sulla malaria, 4ª Nota preliminare del Socio B. Grassi, A. Bignami e G. Bastianelli.

Mountaineering. **Gribble.**

The Early Mountaineers. By Francis Gribble. London: T. Fisher Unwin, 1899. Size 9 × 6, pp. xiv. and 338. *Illustrations. Price* 21*s. Presented by the Publisher.*

Describes the first mountaineers on each of the great mountain systems of Europe, and deals especially with the first references to mountain-climbing in early books. A number of reproductions of quaint maps, views, and title-pages adds much interest to the descriptions. A series of appendices contains the *ipsissima verba* of some of the most ancient descriptions.

Scientific Societies—Year-Book. ——

Year-Book of the Scientific and Learned Societies of Great Britain and Ireland: comprising Lists of the Papers read during 1898 before Societies engaged in Fourteen Departments of Research, with the names of their Authors. Sixteenth Annual Issue. London: C. Griffin & Co., 1899. Size 9 × 5½, pp. iv. and 288. *Presented by the Publishers.*

Shipwrecks. *Ann. Hydrographie* **27** (1899): 239–255. **Herrmann.**

Ort und Ursache der Strandungen deutscher Seeschiffe. Von J. Herrmann.

Statements as to the positions in which German vessels have been lost in all parts of the world.

Swiss Geographical Congress. ——

XII^me^ Congrès des Sociétés Suisses de Géographie tenu à Genève du 4 au 7 Septembre 1898.—Le Globe. Numéro Spécial. Genève, 1898. Size 10 × 6½, pp. 96. *Presented by the Geographical Society of Geneva.*

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Bartholomew.**

Bartholomew's Reduced Ordnance Survey of England and Wales. Scale 1 : 126,720 or 2 stat. miles to an inch. Sheets: 29, Berks and Wilts; 36, South Devon. J. Bartholomew & Co., Edinburgh, 1899. *Price* 2*s. each*, mounted on cloth. *Presented by the Publishers.*

England and Wales. **Ordnance Survey.**

Publications issued since July 8, 1899.

1-inch—General Maps:—

ENGLAND AND WALES:—150 (revision), engraved in outline; 93, 98, 205, 277, 293, 295, 323, 324, 337, 347 (revision), hills engraved in black or brown. 1*s. each.*

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ENGLAND AND WALES:—**Derbyshire,** 6 N.E., 22 S.W., S.E. **Hertfordshire,** 6 S.E., 25 N.W., S.E. **Northumberland,** 1 S.E., 3 S.W., 97 S.W. **Sussex,** 47 S.W.

25-inch—Parish Maps:—

ENGLAND AND WALES:—**Berkshire,** V. 12; VI. 9, 10, 11, 14; VII. 2, 3, 10; IX. 3, 4, 7, 8; X. 3; XXIV. 1; XXX. 14; XXXVIII. 4, 6, 7, 8, 10, 12, 16; XXXIX. 14, 15, 16; XL. 9, 13; XLVI. 3, 4, 6, 7, 8, 10, 11, 12. **Bucks,** XXVI. 6, 7, 10, 11; XXXI. 7; LII. 1; LVIII. 8. **Cheshire,** VII. 15; XIII. 14. **Cumberland,** XXXIII. 16; XXXIV. 5, 9, 10, 13, 14, 15; XLI. 4; XLII. 1, 3, 5, 6, 7; LXVI. 6; LXVII. 7, 13; LXVIII. 5, 13; LXXII. 1 and 5, 2; LXXIII. 1. **Derby,** XXXII. 12; XXXIII. 5, 7, 8, 12; XXXVI. 1. **Denbigh,** VA. 15; IX. 15; XIV. 4, 8, 12; XV. 9; XX. 3, 11; XXIX. 1, 5, 9, 13; XXXVI. 1. **Flint,** I. 8, 12; II. 5; IV. 8, 12; V. 2, 5, 8, 13, 15; VI. 13, 15, 16; VIII. 10, 11, 15, 16; IX. 3, 5, 9, 13, 14; X. 10; XII. 4, 8, 12; XIII. 3, 9; XVI. 3, 11; XVII. 5; XX. 1; XXII. 9. **Glamorgan,** XV. 9; XXIV. 4; XXV. 10, 14, 15; XXVI. 4, 13, 14; XXXIII. 3, 4, 7, 8; XXXIV. 1, 3, 7, 9, 10, 14, 16; XXXIX. 3, 4; XLIV. 12, 16. **Nottinghamshire,** VI. 2, 3, 4, 6, 7, 8, 9, 10, 11, 12; VII. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11; XXVII. 3. **Oxfordshire,** XXIV. 7, 8, 11, 12, 15, 16; XXVI. 5, 6, 9, 10, 13, 14; XXVII. 6, 7, 8, 11, 12; XXVIII. 5, 6, 7, 9, 10, 11; XXX. 2, 3; XXXII. 1, 2, 3, 4, 5; XXXIV. 2, 7, 10, 14; XXXVI. 2; XXXVIII. 12; XXXIX. 11; XL. 1, 5, 9, 13; XLIII. 3; XLVI. 1. **Staffordshire,** VII. 4; VIII. 6, 9; IX. 12, 15; XIV. 2, 10, 11. **Sussex,** XXVII. 1; LIV. 13; LVIII. 7, 8, 12; LIX. 13; LXVII. 11, 14, 16; LXVIII. 1, 2, 6, 7, 9, 11, 14, 15, 16; LXIX. 1, 5, 14, 15, 16; LXXVIII. 1, 5; LXXIX. 2, 4, 5, 7, 11, 15, 16; LXXX. 5, 6; LXXXII. 3, 4.

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Germany. **Topogr. Bureau des K. Bayer. General-Stabes.**

Karte des Deutschen Reiches. Herausgegeben vom Topogr. Bureau des K. Bayer. General-Stabes, 1898. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 665, Schliersee; 672, Mittenwald. *Price* 1.50 *marks each sheet.*

Italy. **Istituto Geografico Militare, Firenze.**

Carta d'Italia. Scale 1 : 100,000 or 1·6 stat. mile to an inch. F°. 5, Val Formazza; 7, Pizzo Bernina; 11, M. Marmolada; 12, Piere di Cadore; 13, Ampezzo; 14, Pontebba; 15, Domodossola; 18, Sondrio; 19, Tirano; 23, Belluno; 24, Maniago; 25, Udine; 29, Monte Rosa; 32, Como; 33, Bergamo; 38, Conegliano; 39, Pordenone; 40, Palmanova; 98, Vergato; 99, Faenza; 100, Forli; 101, Rimini; 107, Monte Falterona; 108, Mercato Saraceno; 109, Pesaro; 110, Senigallia; 113, S. Casciano in Val di Pesa; 114, Arezzo; 115, Citta di Castello; 116, Gubbio; 117, Jesi; 118, Ancona; 120, Siena; 121, Montepulciano; 122, Perugia; 123, Gualdo Tadino; 124, Macerata; 125, Fermo; 126, Isola d'Elba; 127, Piombino; 128, Grosseto; 130, Orvieto; 131, Foligno; 132, Norcia; 133, Ascoli Piceno; 134, Giulianova; 135, Orbetello; 136, Toscanella; 166, Isola Asinara; 167, Isola Rossa; 179, Porto Torres. Istituto Geografico Militare, Firenze. *Price* 1 *lire* 50 *centimes each sheet.*

Sweden. **Sveriges Geologiska Undersökning.**

Sveriges Geologiska Undersökning. Scale 1 : 50,000 or 0·8 stat. mile to an inch. Sheet: Örkelljunga. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheet: Ulricehamn. Öfversightskarta angifrande de Kvartära Hafsaflagringarnes område samt Kalkstensoch Mergelförekomsters utbredning. Scale 1 : 2,000,000 or 32 stat. miles to an inch. Tryckt i General Stabens Litogr. Anstalt, Stockholm. *Presented by the Director of the Geological Survey of Sweden.*

ASIA.

Asia Minor. **Friedrich and Ruge.**

Archäologische Karte von Kleinasien, bearbeitet von Dr. W. Ruge u. Dr. E. Friedrich. Scale 1 : 2,500,000 or 39·5 stat. miles to an inch. Verlag v. G. Sternkopf, Halle a/S, 1899. *Price* 3 *marks. Presented by the Publisher.*

Students will find this a useful map, as all the ancient, as well as modern, names of

places are given. There are two insets, one showing recent routes, and the other the Plain of Troy. It is furnished with a complete index.

China. **Cholnoky.**

Map of the Mouth of the Yang-tse-kiang, and surrounding country. Scale 1 : 1,300,000 or 20·5 stat. miles to an inch. By Eug. de Cholnoky. 1899. In Hungarian. *Presented by the Author.*

This map of the delta of the Yang-tse-kiang contains some new work, which would appear to be the result of the author's survey. The title and explanation of the symbols employed are in Hungarian.

AFRICA.

Transvaal. **Stanford.**

Map of the South African Republic (Transvaal). Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. London: E. Stanford, 1899. *Presented by the Publisher.*

This map has been brought up to date. All means of communication are shown, and the heights of some prominent positions are given in figures. As there is no hill-shading, there is nothing to indicate the relief of the country; it is, however, a useful map for reference.

AMERICA.

Canada. **Surveyor-General of Canada.**

Sectional Maps. Scale 1 : 190,080 or 3 stat. miles to an inch. Sheet: 96, Port Moody. Topographical Surveys Branch, Department of the Interior, Ottawa, 1899. *Presented by the Surveyor-General of Canada.*

GENERAL.

World. **Meyer.**

Meyer's Hand-Atlas. Zweite, neubearbeitete und vermehrte Auflage mit 112 Kartenblättern, 9 Textbeilagen und Register aller auf den Karten verzeichneten Namen. Part 15 and 16. Leipzig und Wien. Verlag des Bibliographischen Instituts, 1899. *Price* 60 *pf.*

World. **Vivien de Saint Martin and Schrader.**

Atlas Universel de Géographie. Ouvrage commencé par M. Vivien de Saint Martin et continué par Fr. Schrader. Paris: Librarie Hachette et Cie. Sheets: Russie d'Europe; Afrique Français. *Price* 2 *fr.*

These two issues contain maps of Russia in Europe, and sheet 2 of the French possessions in Africa. Each sheet is accompanied by letterpress, in which the authorities consulted are mentioned.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, May and June, 1899. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3049 to 3060		Tidal streams:—English and Irish channels. 4*s.* The same twelve charts bound together in an atlas. 5*s.*
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607 m = {0·9 / 1·8} Africa, west coast:—Salem and Jumbas rivers, Fundium. 2*s.*

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3040 m = 4·2 Russian Tartary:—Vostok bay. 1*s.* 6*d.*

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487 St. Christopher and Neris:—Plans added, Basseterre bay.

1117 Anchorages in the Russian Tartary:—New Plan, Trinity bay.

984 Anchorages in the Marshall islands:—Plan added, Eniwetok or Brown atoll.

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Charts Cancelled.

No.		Cancelled by	No.
114B	Fisherrow to Queensferry.	New chart. Fisherrow to Port Edgar	1146
1156	Nickerie river appoaches.	New chart.	
99	Salut isles anchorage.	Plans on the east coast of South America.	99
607	Entrances to the Salem and Jumbas rivers.	New plan. Salem and Jumbas rivers	607
54	Plan of Port Lazaref on this sheet.	New plan. Port Lazaref and Yung-hing bay	3037
2511	Plans of Nakhodka bay and Wrangle bay on this sheet.	New chart. America bay	3041
2407	Plan of Gaidamak bay on this sheet.	New chart. Vostok bay	3040
1644	Komandorski islands.	New chart. Komandorski islands	1644
778	Eniwetok or Brown group.	New plan. Eniwetok or Brown atoll	984
1380	New Caledonia, New Hebrides and Loyalty islands.	New chart. New Hebrides islands and New Caledonia	3033

Charts that have received Important Corrections.

No. 2585, England:—Coastguard stations. 2587, Ireland:—Coastguard stations. 1951, England, west coast:—Liverpool bay. 1192, England, east coast:—Hartlepool to St. Abbs head. 1626, England, east coast:—Blyth. 2593, Germany, west coast:—Ameland to Jade river. 1875, Germany, west coast:—Elbe, Weser, and Jade rivers. 2260, Norway:—Christiansand and Songvaar fiords. 2751, Spitsbergen. 185, Germany, north coast:—Port Swinemünde. 86, Spain, west coast:—Cadiz bay. 1187, Spain, east coast:—Alicante to Palamos. 1354B, Falkland islands. 260, North Polar sea. 274, North Polar chart, Atlantic side. 2282, Arctic ocean and Greenland sea. 282, Newfoundland:—Saint John bay to Orange bay. 2775, River St. Lawrence:—Point Pizeau to Frechette island. 2777, River

St. Lawrence:—Frechette island to Cape Santé. 2778, River St. Lawrence:—Cape Santé to Grondine. 2779, River St. Lawrence:—Grondine to Batiscan. 2780, River St. Lawrence:—Batiscan to Becancour. 2781, River St. Lawrence:—Becancour to port St. Francis. 2782, River St. Lawrence:—East part of Lake St. Peter. 2783, River St. Lawrence:—West part of Lake St. Peter. 2784, River St. Lawrence:—Stone island to Lanoraie. 2785, River St. Lawrence:—Lanoraie towards Contrecœur. 2786, River St. Lawrence:—Contrecœur to Repentigny. 2787, River St. Lawrence:—Repentigny to Long point. 2788, River St. Lawrence:—Long point to Lachine rapids. 1127, River St. Lawrence:—Montreal harbour. 2882, United States, east coast:—Gloucester harbour. 2486, United States, east coast:—Plymouth harbour. 2806, United States, east coast:—Charleston harbour. 478, Puerto Rico:—Port San Juan, Port Arecibo. 3005, United States, south coast:—Tortugas harbour. 3029, British Columbia:—Active pass to Gabriola pass. 2812, Africa, west coast:—Lagos harbour. 2432, Russian Tartary:—Tumen Ula to Strelok bay. 936B, New Caledonia, south-east part. 2069, New Caledonia:—Approaches to Port Nouméa. 480, New Caledonia:—Port Nouméa. 474, Friendly islands:—Nomuka islands.

(*J. D. Potter, Agent.*)

English and Irish Channels. **Hydrographic Department, Admiralty.**

Tidal Streams of the English and Irish Channels. Published at the Hydrographic Department, Admiralty, under the superintendence of Admiral Sir W. J. L. Wharton, Hydrographer, London, 1899. 12 sheets. *Price 5s. Presented by the Hydrographer.*

North Sea.

Tidal Streams of the North Sea. Published at the Hydrographic Department, Admiralty, under the superintendence of Admiral Sir W. J. L. Wharton, Hydrographer, London, 1899. 12 sheets. *Price 5s. Presented by the Hydrographer.*

These atlases each contain twelve charts, showing the direction and rate in knots of the tidal streams of the North sea and the English and Irish channels for every hour of the tide at Dover. They are based on the extensive observations made by the late Captain F. W. Beechy, R.N., F.R.S., and are supplemented, or verified, by the results of Admiralty surveys, and observations taken by permission of the Trinity House, at the different lightships round the coast.

With regard to the charts of the North sea, much valuable information concerning the tidal streams off the coast of Holland has been obtained from an account by Lieut. H. Bernelot Moens of the Dutch navy, of a series of careful observations made from 1880 to 1882. Observations made at the different lightships on the Danish, Dutch, Belgian, and French coasts have been furnished by the respective governments.

The charts of the English and Irish channels have been supplemented by observations from various Admiralty surveys up to date, especially by those, at the entrance of the channel, by Admiral Pelham Aldrich, R.N., in 1889–90.

The state of the tide, whether rising or falling, has been noted along the coast, and a notice is given that these are general statements for different portions of the coast, and necessarily apply to individual harbours or bays.

The compilation of this vast amount of material has been carried out by Commander Cortland H. Simpson, R.N.

Russian Charts. **Chief Hydrographic Department, Ministry of Marine, St. Petersburg.**

Charts and Plans published by the Chief Hydrographic Department, Ministry of Marine, St. Petersburg.

The White Sea.

No.
519. Plan of Suma. Scale 1750 feet to an inch. 1899.

The Baltic.

1810. Plan of Wismar bay. Scale 3700 feet to an inch. 1899.
528. Approaches to Arensburg. Scale 3500 feet to an inch. 1899.
524. Plan of Revel. Scale 188 feet to an inch. 1899.
522. Plan of port of Windau. Scale 420 feet to an inch. 1899.

Black Sea.

525. Plan of Karaji bay, Crimea. Scale 1400 feet to an inch. 1899.
449. Plan of Balaklava bay, Crimea. Scale 175 feet to an inch. 1896.
1760. Plan of the neighbourhood of Cape Khersonese, Crimea. Scale 1050 feet to an inch. 1899.
530. Plan of the Kilia mouth of the Danube. Scale 5250 feet to an inch. 1899.
526. Plan of Port Tuabs. Scale 1400 feet to an inch. 1899.
527. Plan of Bender Erekli bay. Scale 1365 feet to an inch. 1899.

Caspian Sea.

523. Plan of the Muravieff bay (with Krasnovodsk). Scale 1750 feet to an inch. 1899.

North Pacific Ocean.

520. Plan of Naisdnik bay (Askold island). Scale 1400 feet to an inch. 1898.
516. Eastern coast of the Korean peninsula. Scale 8·2 stat. miles to an inch. 1898.
515. Plan of the creeks of Trinity and Vitzay in the bay of Possiet. Scale 1400 feet to an inch. 1898.
514. Chart of the western coast of Peter the Great bay. Scale 4550 feet to an inch. 1898.
521. Chart from Peter the Great bay to the southern extremity of Korea. Scale 16·2 stat. miles to an inch. 1899.

Presented by the Chief Hydrographic Department, St. Petersburg.

PHOTOGRAPHS.

British East Africa and Mediterranean. **Molesworth.**

Fourteen Photographs of British East Africa, Cape Guardafui, and Stromboli, taken by Sir Guilford L. Molesworth. *Presented by Sir Guilford L. Molesworth.*

The following photographs, presented by Sir Guilford L. Molesworth, were taken by him on his expedition in East Africa, and during his voyage.

(1) Baobab, British East Africa; (2) Baobab, Mimban; (3) Masai on the war-path; (4) Porters; (5) Wanika; (6) Wa-Kikuyu; (7) Wa-Kikuyu; (8) Wa-Kikuyu; (9) Wa-Kikuyu; (10) Lingonet volcano; (11) Lingonet; (12) Cape Guardafui; (13) Guardafui; (14) Guardafui; (15) Stromboli.

Central Africa. **Crawford**

Twelve Photographs of the Country in the Neighbourhood of Lake Mweru, Garenganze Country, by D. Crawford, Esq. *Presented by F. S. Arnot, Esq.*

This is a series of photographs taken by Mr. D. Crawford in the vicinity of the Lualaba river and Lake Mweru. The following is a list of their titles:—

(1) Looking north from "Holy Mount" down the Lualaba; (2) Lualaba river near Kalamata's; (3) Lualaba, looking south from an island; (4) Sphinx Mbuyu in Luba village; (5) Lualaba river at sunset; (6) View of Lualaba river; (7) "Holy Mount" where tribal deities are worshipped; (8) Looking down on village of Nyembo-kundu, Lualaba river; (9) In a Lake Mweru water-forest; (10) Lualaba river; (11) Looking down the Lualaba river from mountain-top; (12) Garenganze natives drawing copper wire.

North-West Frontier of India. **Tate.**

Sixteen Photographs of British Baluchistan and the Country in the Neighbourhood of the Railway to Kandahar, by G. P. Tate, Esq. *Presented by G. P. Tate, Esq.*

This is an exceptionally good set of photographs; the subjects are well chosen, and convey an excellent idea of the scenery of the country. The following are their titles:—

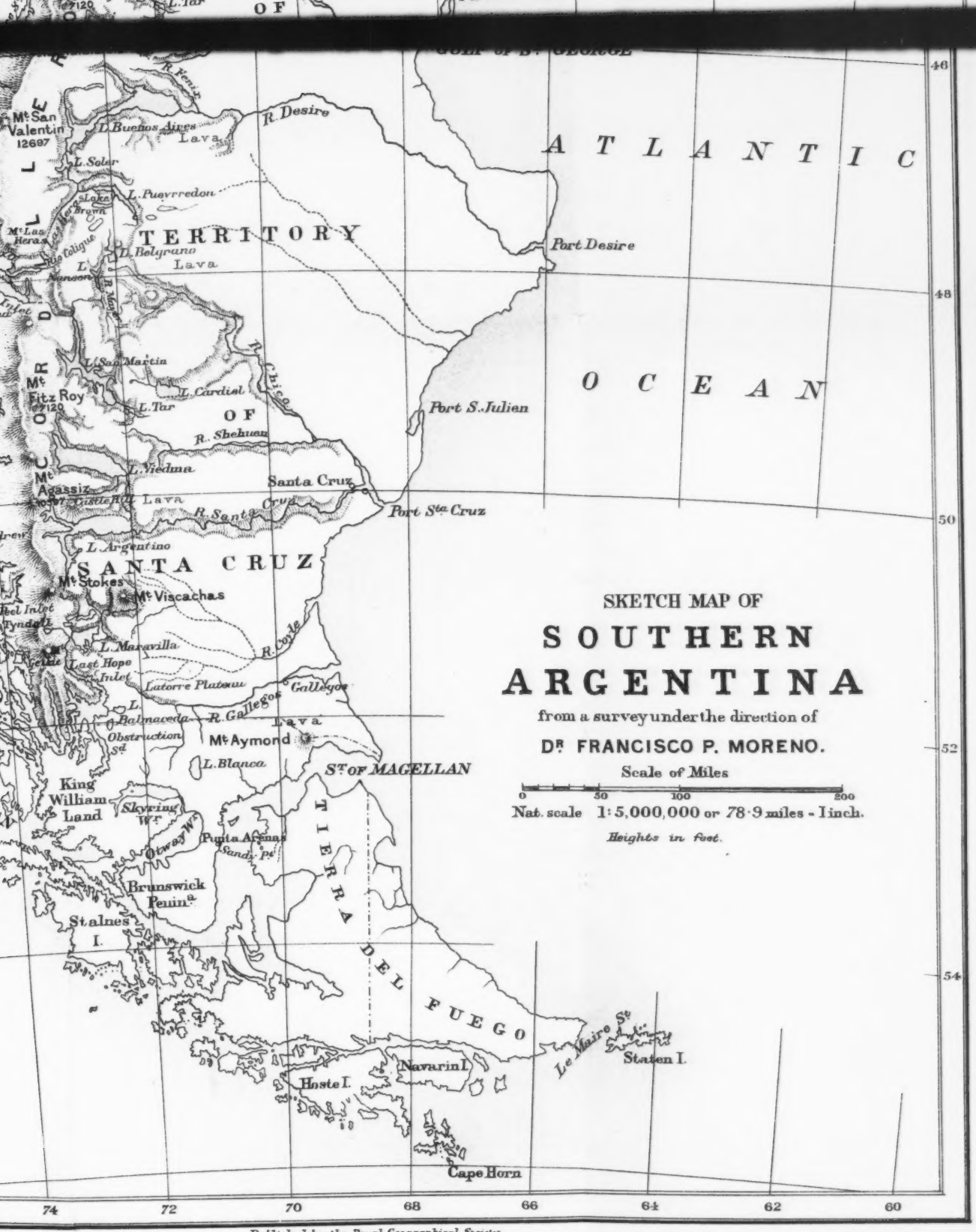
(1) View near the Koh-i-Malak, Siah; (2) The Matiki Gat hill; (3) View from near Camp Rabat with Lar Koh hills in distance; (4) The Kuh-i-Taftan; (5) Spur of the Rabat-Koh hill with camp; (6) Gorge at Amirchah; (7) Sandhills and rocks, Amirchah; (8) Kuh-i-Khwajah from eastern edge of Hamun-i-Helmand, Sistan; (9) Tutins, or reed boats on the Helmand Hamun, Sistan; (10) Luris, or Baluch gypsies; (11) Post at Dalbandin, Quetta-Sistan trade route; (12) Ruins of Kahkah, on slope of Koh-i-Khwajah, Sistan; (13) Contorted strata rocks, Padagi hills; (14) Crater of Damodim looking towards the south; (15) Outpost at Marui, on the Quetta-Sistan trade route; (16) No title.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

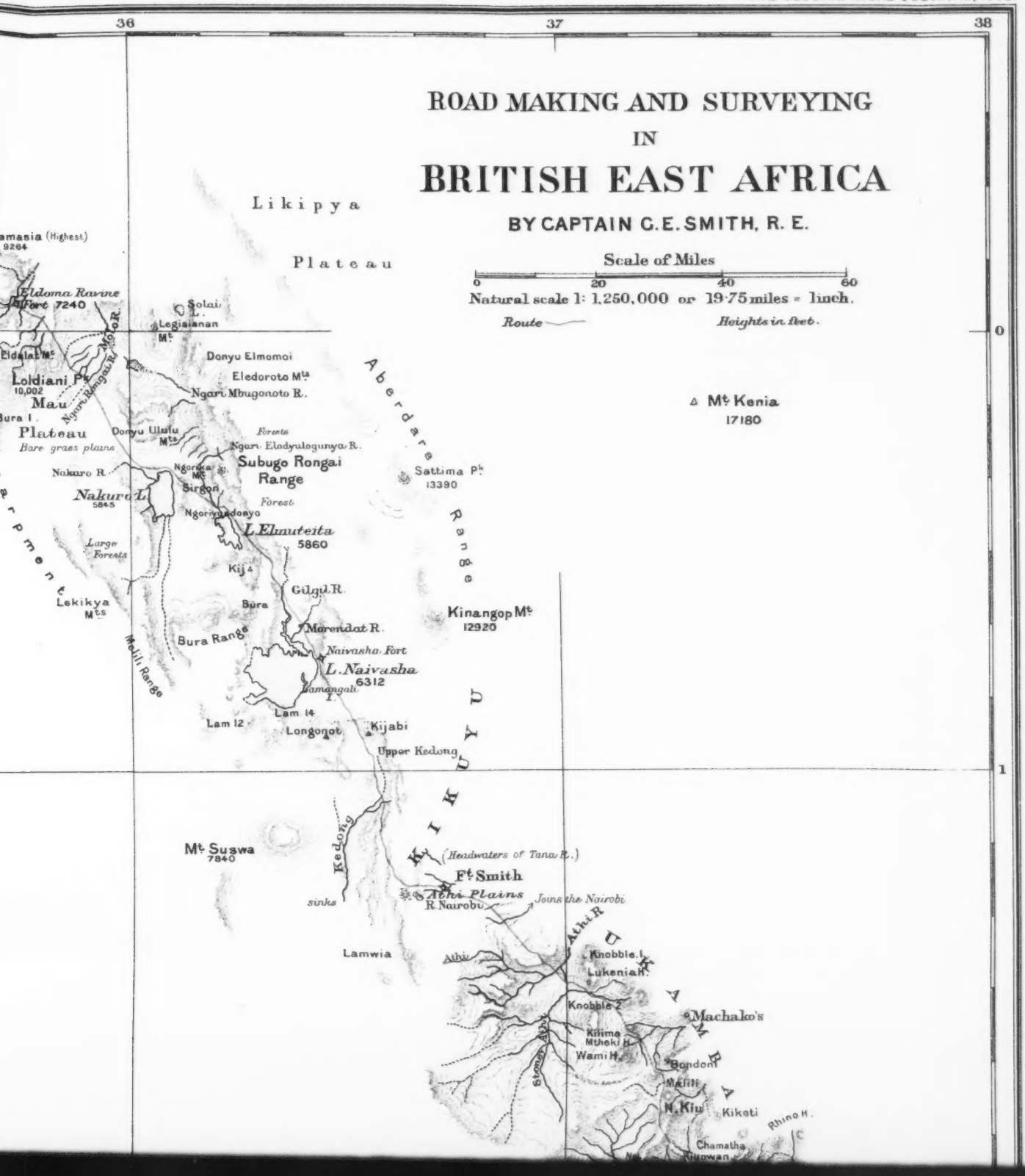
74
40
42
44
46
48
SOUTH PACIFIC OCEAN
L. Nahule Huapi
Llanquihue L.
Pte Montt
Chiloe I.
4999
Huafo I.
CHONOS ARCHIPELAGO
Mt San Valentin 12697
GULF OF PENAS
Wager I.
Byron I.
Campana I.

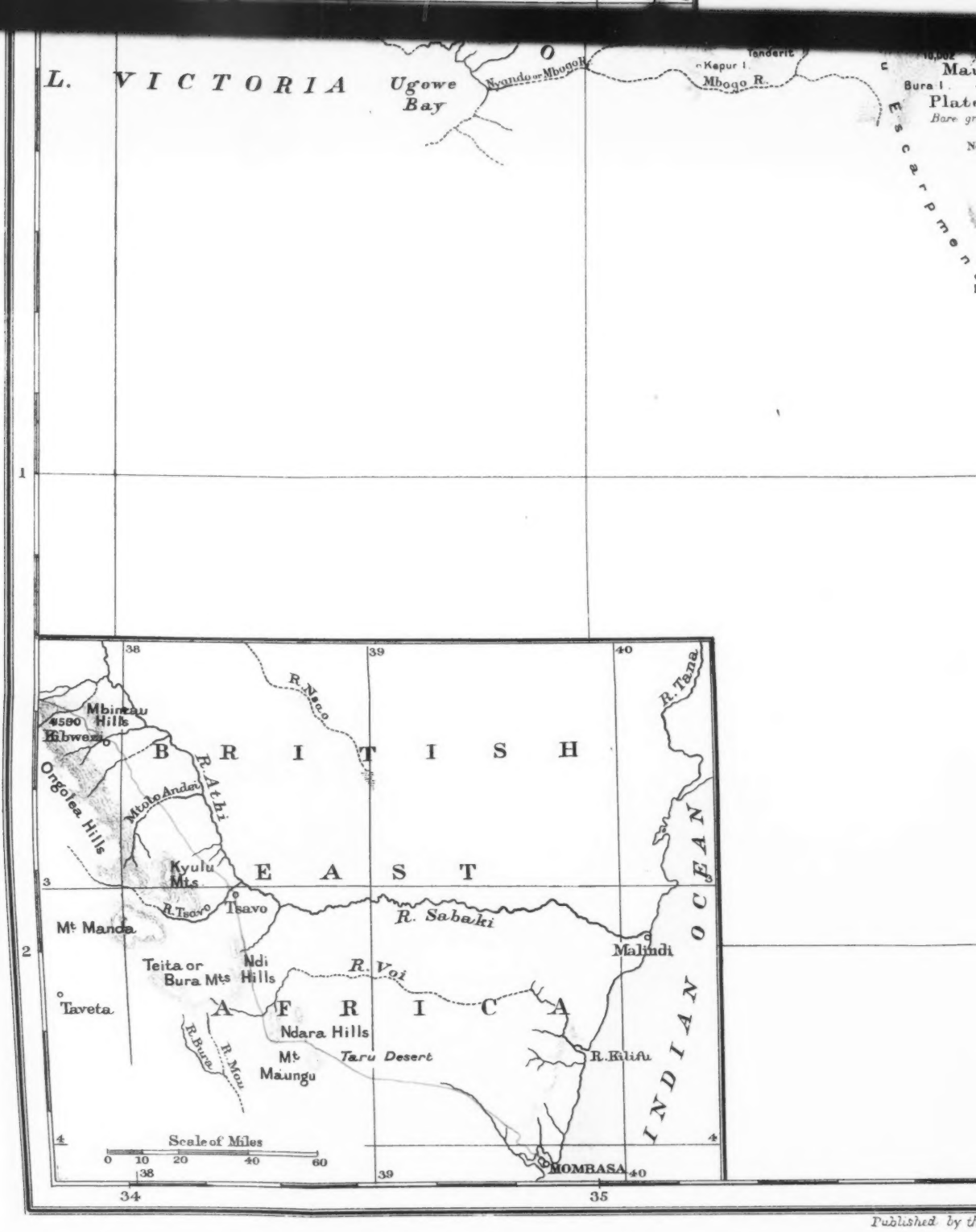
72
70
68
66
64
62
40
42
44
46
48
Mt Lanin 12041
L. Huechu Lafquen
Junin de los andes
Confluencia
Choelechoel I.
R. Colorado
Rio Negro
Port San Antonio
R. Limay
R. Collon Cura
Lacar
L. Traful
TERRITORY OF
RIO NEGRO
GULF OF SAN MATIAS
Mt Tronador
R. Manso
R. Puelo
L. Puelo
San Jose B.
Pto Madryn
Nuevo Gulf
L. Menendez
Minchimahuida
12th October
R. Chubut
R. Tecka
Trelew
Rawson
TERRITORY OF
CHUBUT
R. Chubut
L. Rivy
R. Pico
R. Cherquenco
R. Chico
R. Cisne
L. La Plata
L. Fontana
R. Senguerr
L. Colhue
L. Musters
SOUTH
R. Aysen
Lava
R. Mayo
GULF OF ST GEORGE
R. Fenix
R. Desire
L. Buenos Aires
Lava
ATLANTIC
L. Soler
L. Pueyrredon
Lake Brown
TERRITORY
Port Desire
L. Belgrano
Lava
R. Chico
L. San Martin
L. Cardiel
L. Tar
OF
OCEAN
Port S. Julien

46
48
50
52
54
78
76
GULF OF PENAS
Wager I.
Byron I.
Campana I.
Wellington I.
Trinidad Chan.
Madré I.
Hanover I.
QUEEN ADELAIDE
ARCHIPELAGO
ST OF MAGELLAN
Desolation I.
PACIFIC OCEAN

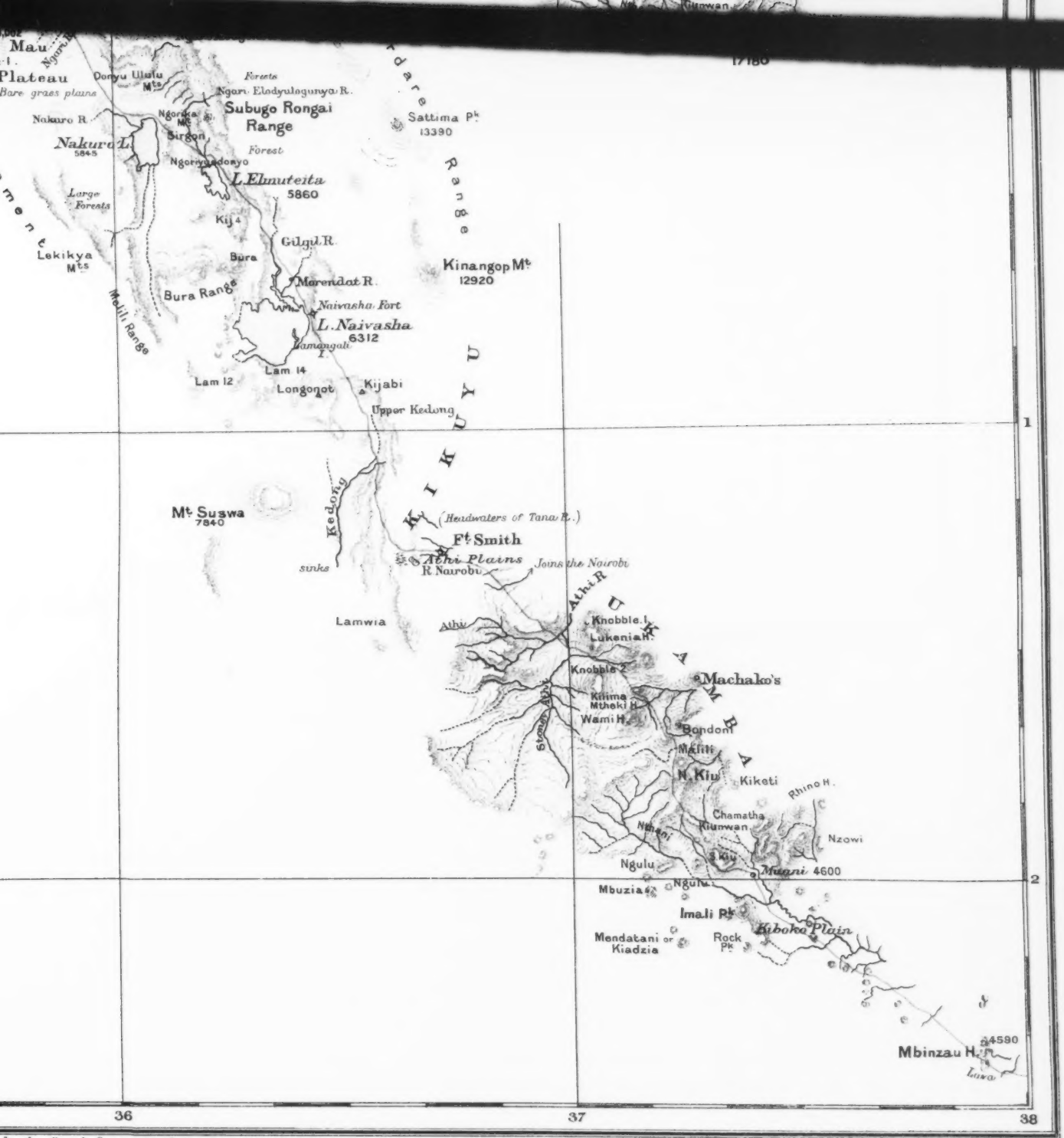

SKETCH MAP OF
SOUTHERN
ARGENTINA
from a survey under the direction of
Dr FRANCISCO P. MORENO.
Scale of Miles
0 50 100 200
Nat. scale 1:5,000,000 or 78·9 miles - 1 inch.
Heights in feet.
ATLANTIC
OCEAN
TERRITORY
SANTA CRUZ
TIERRA DEL FUEGO
St. OF MAGELLAN
Port Desire
Port S. Julien
Port Stª Cruz
Santa Cruz
Gallegos
Lava
Mt Aymond
Mt Viscachas
Mt Stokes
Mt San Valentin 12697
Mt Fitz Roy 12720
Mt Agassiz
Navarin I.
Staten I.
Cape Horn
Le Maire St.
Published by the Royal Geographical Society.

34
35
0
1
3
38
39
40
Sangara
Diyali
R. Sio
Machanga
KABRAS
Kamaha
Kiptoiyu
Toholwa's Stone
Alagabeit
Samia
Guoso
Mumias
Lukungu's
R. Nzoia
Nandi Escarpment
Amai R.
Kakamwega
Kavirondo
Berkeley Bay
Port Victoria
Rukus R.
Kipkoiyo
R. Kaimur
Nagarek
Bonyu Lessos
Kamasia 9264
Daragwa
Cerogerok 2400
NANDI
Kepur
Kuyu 6859
Watn 9586
Bongwa
Kemelit
Mwoituti or Kaviyur 8809
Longai or Tenderit
Kepur I.
Mbogo R.
KAVIRONDO
L. VICTORIA
Ugowe Bay
Nyundo or Mbogo R.
Mau Escarp
Eldama
Lol
Bura I
R. Nzoia
Mbimau Hills 4580
Kibwezi
BRITISH
R. Athi
Ongolea Hills
Mtolo Ander
Kyulu Mts.
EAST
R. Tana
EAN

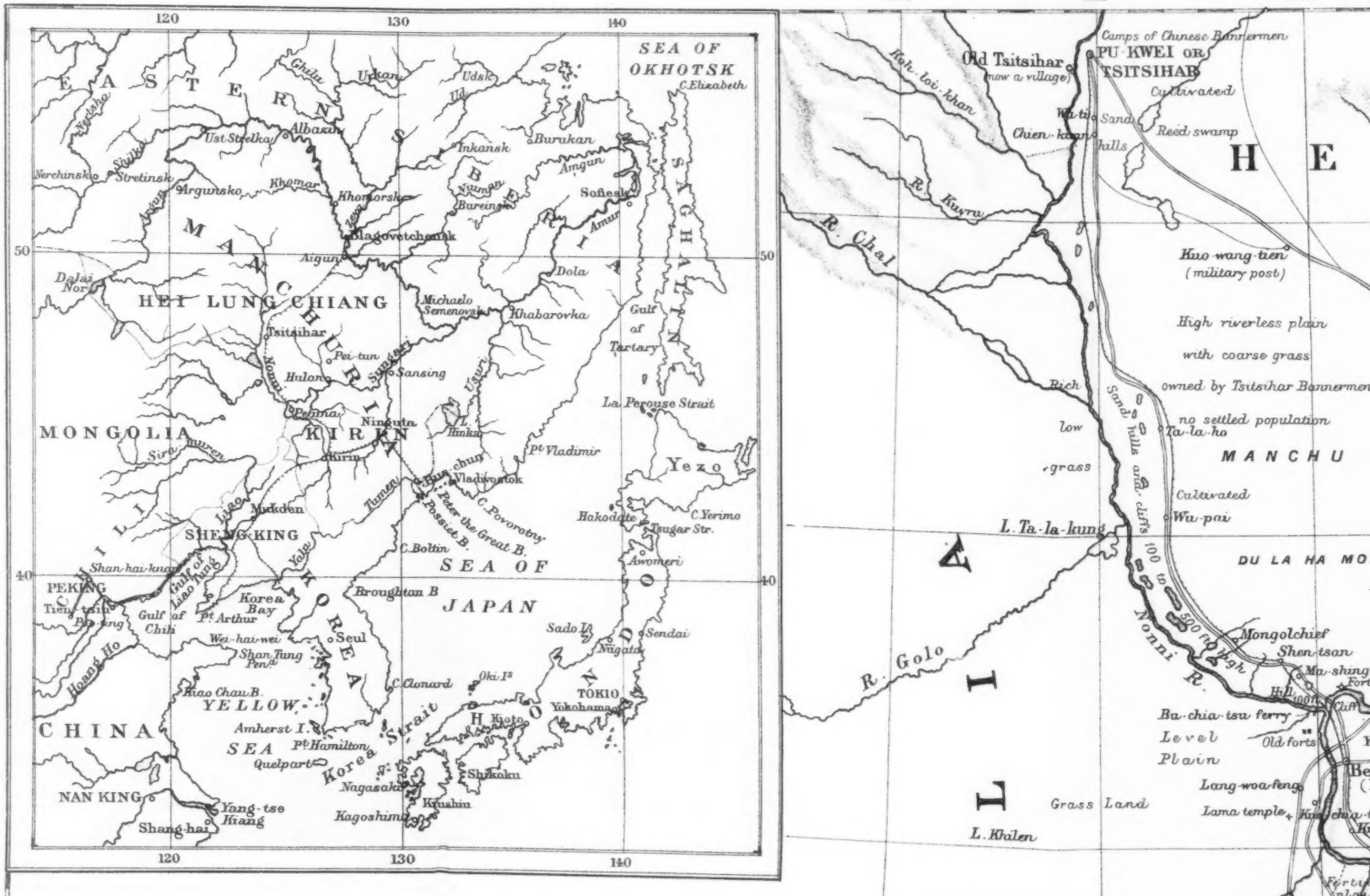

36
37
38
ROAD MAKING AND SURVEYING
IN
BRITISH EAST AFRICA
BY CAPTAIN C. E. SMITH, R. E.
Scale of Miles
0 20 40 60
Natural scale 1: 1,250,000 or 19·75 miles = 1 inch.
Route
Heights in feet.
Likipya
Plateau
Mt. Kenia
17180
Eldoma Ravine
Fort 7240
Solai
Legisianan
Mt.
Eldalas Mt.
Loldiani Pk
10,002
Mau
Plateau
Bare grass plains
Ngoni Rongai Rd
Donyu Elmomoi
Eledoroto Mts
Ngare Mbugonoto R.
Donyu Ululu
Mts
Forests
Ngare Elodyulogunya R.
Subugo Rongai
Range
Nakuro R.
Ngorika
Mt.
Sirgon
Nakuro L.
5845
Forest
Ngoriyadonyo
L. Elmuteita
5860
Large
Forests
Lekikya
Mts
Kij 4
Gilgil R.
Bura
Kinangop Mt.
12920
Morendat R.
Bura Range
Naivasha Fort
L. Naivasha
6312
Lamongah I.
Lam 14
Lam 12
Longonot
Kijabi
Upper Kedong
Aberdare Range
Melili Range
Mt. Suswa
7840
Kedong
sinks
(Headwaters of Tana R.)
Ft. Smith
Athi Plains
R. Nairobi
Joins the Nairobi
Athi R.
Lamwia
Athi
Knobble 1.
Lukenia H.
Knobble 2
Machako's
Kilima
Mtheki H.
Wami H.
Bondoni
Stony Athi
Malili
N. Kiu
Kiketi
Rhino H.
Chamatha
Kilimwan
KIKUYU
UKAMBA
0
1



Published by th



by the Royal Geographical Society.

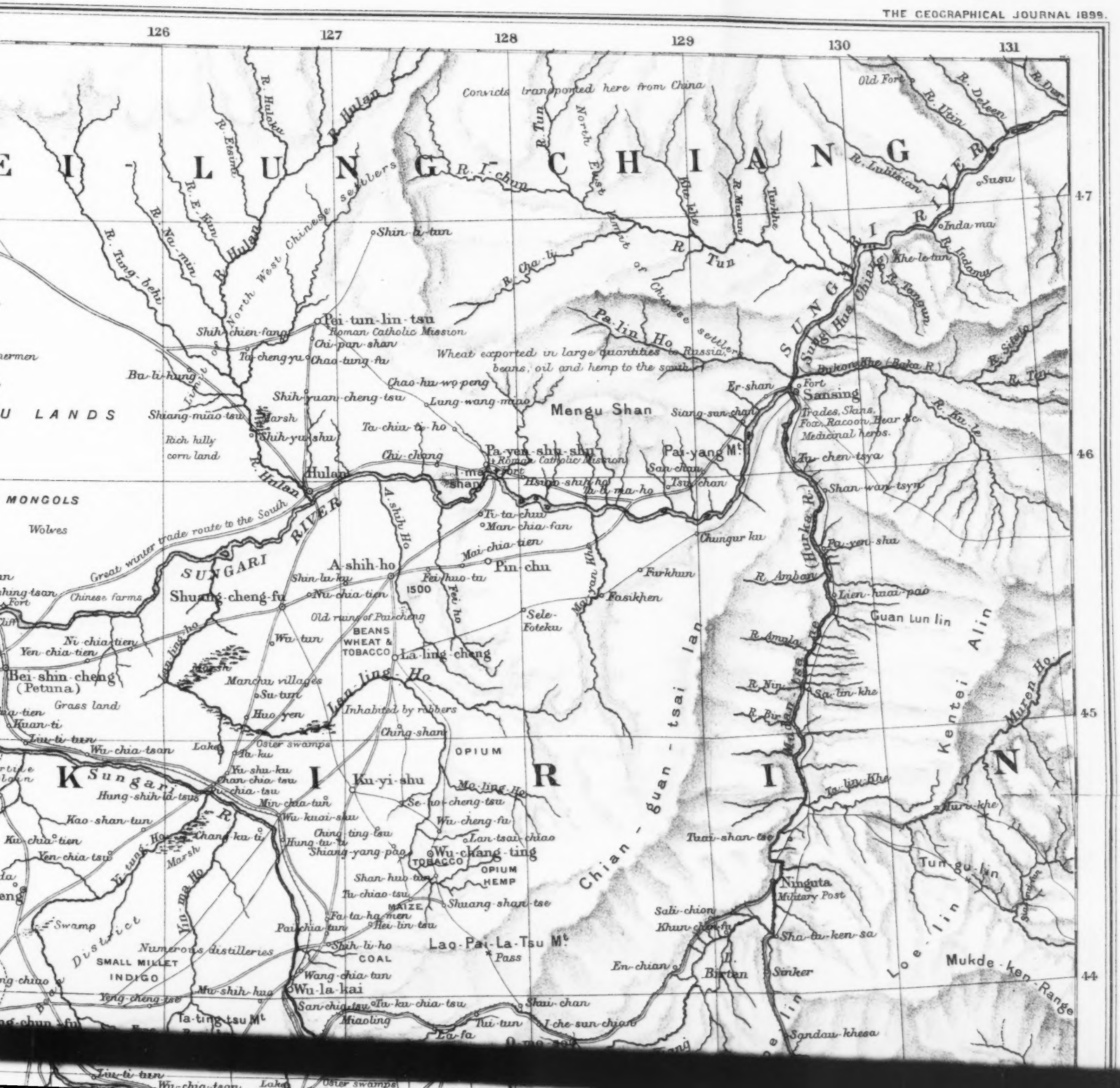


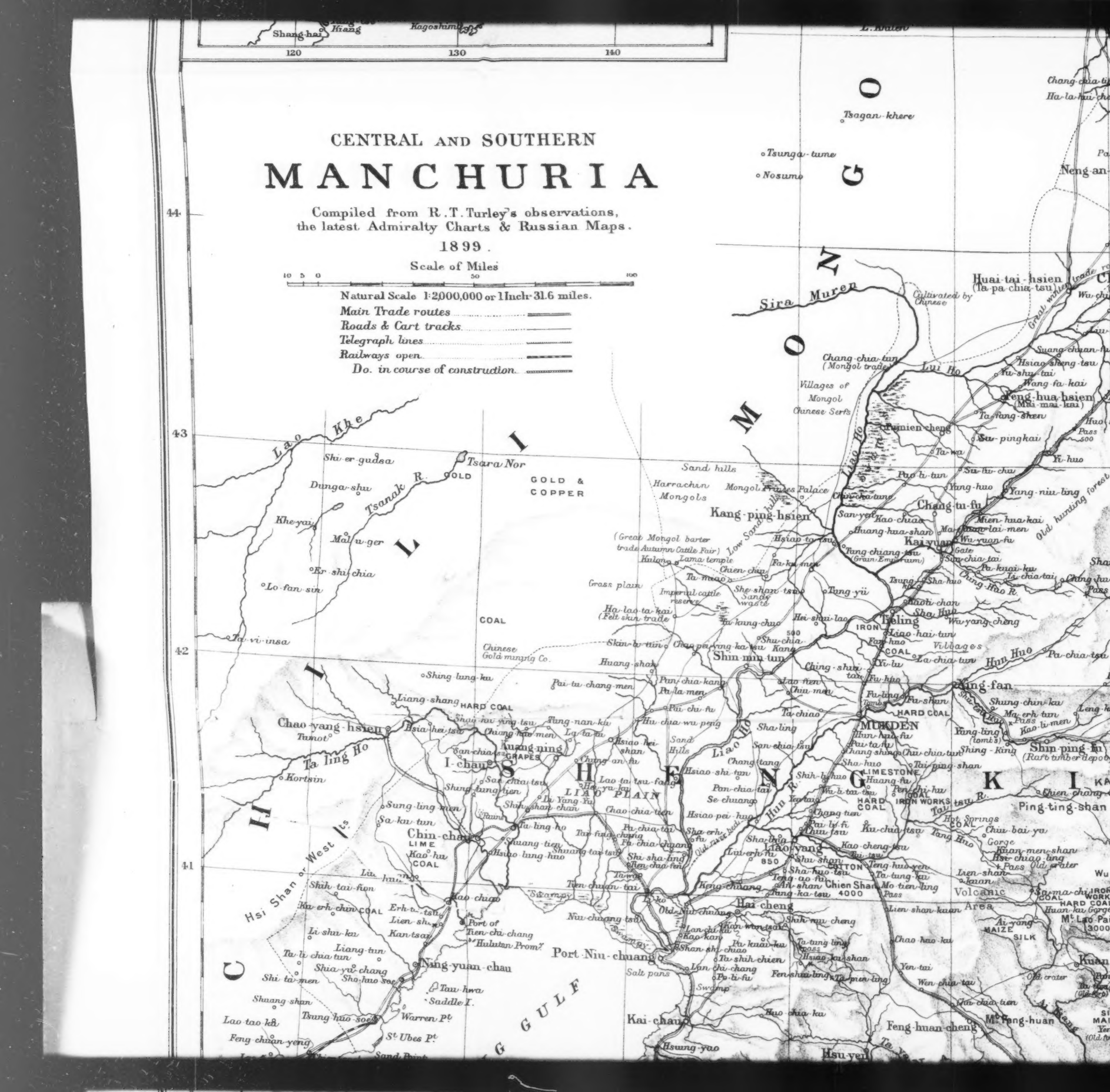
CENTRAL AND SOUTHERN
MANCHURIA

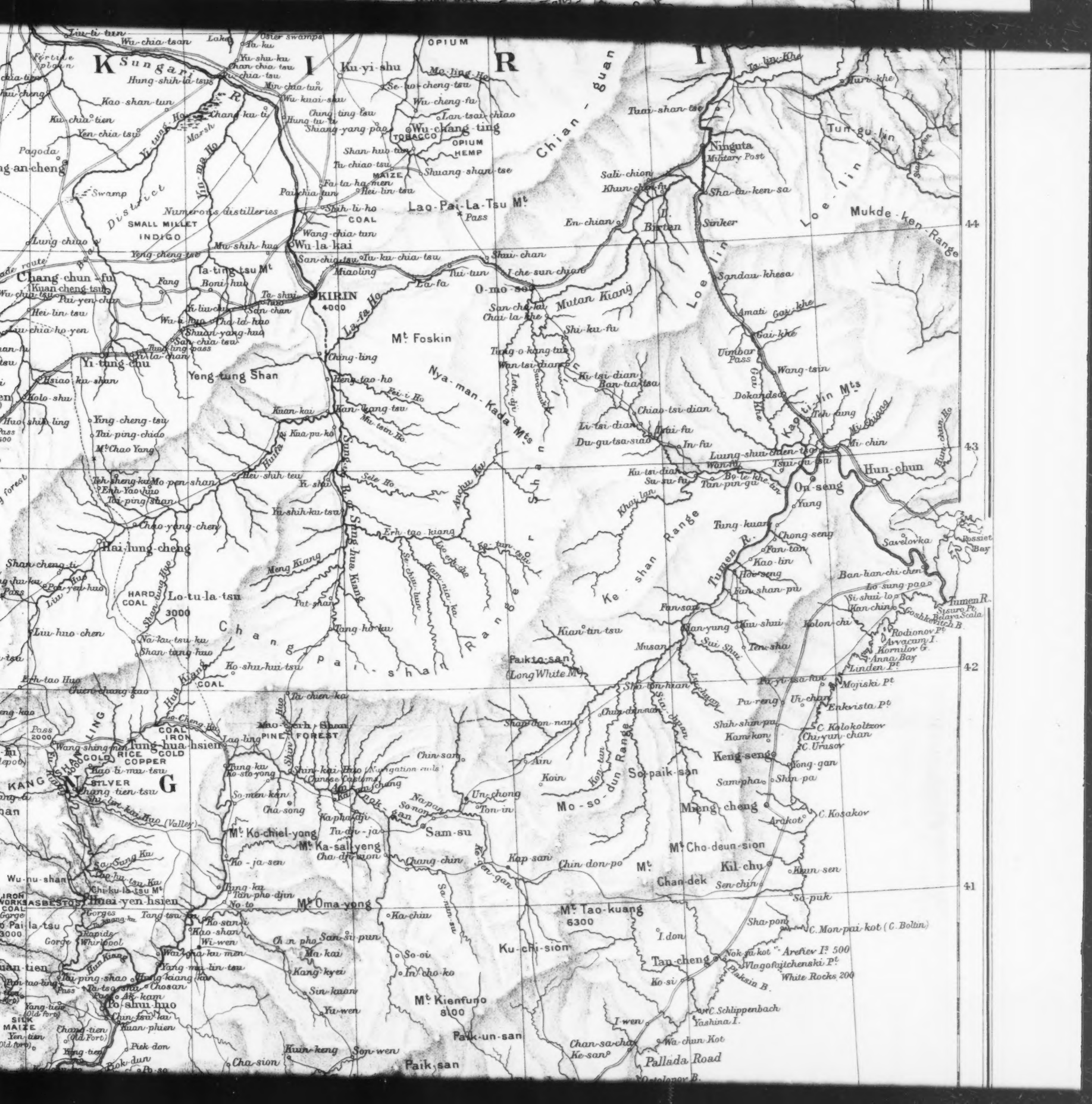
Compiled from R. T. Turley's observations,
the latest Admiralty Charts & Russian Maps.

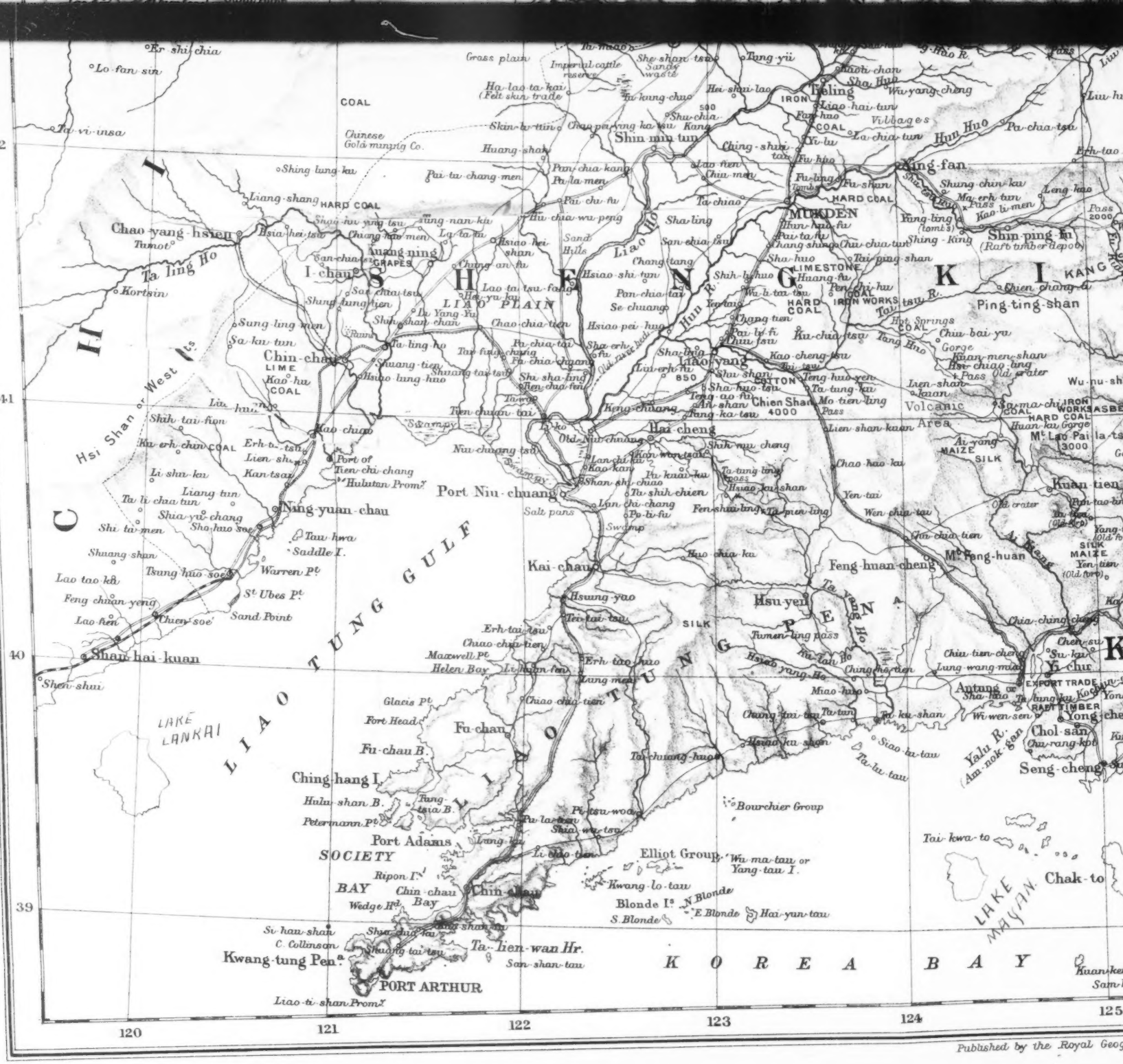
1899.

Scale of Miles


126
127
128
129
130
131
47
46
45
44
E I L U N G C H I A N G
R. Hulan
R. Tung-behi
R. Na-min
R. E-kun
R. Esimo
R. Hulan
North West Chinese settlers
R. I-chun
R. Tun
North East limit of Chinese settlers
R. Cha-li
R. Mutun
R. Turkhe
Kha-lo-chi
Convicts transported here from China
Old Fort
R. Deleen
R. Dzer
R. Utin
R. Lubistan
Susu
Shin-li-tun
Inda-ma
Khe-le-tun
R. Indamu
R. Tengun
Pei-tun-lin-tsu
Roman Catholic Mission
Shih-chien-fang
Chi-pan-shan
Ta-cheng-yu
Chao-tung-fa
Pa-lin Ho
Wheat exported in large quantities to Russia, beans, oil and hemp to the south
Bukon-khe (Boka R.)
R. Sitela
R. Tu
Fort
Sansing
Trades, Skins, Fox, Racoon, Bear &c. Medicinal herbs.
R. Ku-le
Er-shan
Chao-hua-wo-peng
Shih-yuan-cheng-tsu
Lung-wang-miao
Mengu Shan
Siang-sun-chan
Ba-li-hung
Liu-li
Shuang-miao-tsu
Marsh
Rich hilly corn land
Shih-yu-shu
Ta-chia-ti-ho
Pa-yen-shu-shu
Roman Catholic Mission
Fort
Pai-yang Mt.
San-chan
Tsui-chan
Tu-chen-tsya
Shan-wan-tsyn
Chi-chang
Hulan
Hsiao-shih-ho
Ta-li-ma-ho
R. Hulan
A-shih-ho
Ti-ta-chui
Man-chia-fan
Mai-chia-tien
Pin-chu
Chungur ku
Pa-yen-sha
R. Argun (Hurka R.)
Lien-hua-pao
Guan Lun lin
R. Amula
R. Nin
Sa-lin-khe
R. Bir
Kentei Alin
Muren Ho
Chian-guan-tsai lan
Furkhan
Fasikhen
Sele-Foteku
Great winter trade route to the South
MONGOLS
Wolves
SUNGARI
RIVER
Shuang-cheng-fu
Chinese farms
Old ruins of Pa-cheng
Nu-chia-tien
Shin-lu-ku
Fei-huo-ta
1500
Fei-ho
Ma-yuan-khe
Ni-chia-tien
Yen-chia-tien
Wa-tun
BEANS WHEAT & TOBACCO
La-ling-cheng
Lan-ling-Ho
Bei-shin-cheng (Petuna)
Manchu villages
Su-tun
Grass land
Huo-yen
Inhabited by robbers
Chang-shan
Oster swamps
Lake
Ta-ku
OPIUM
Ku-yi-shu
Ma-ling-Ho
Se-ho-cheng-tsu
Wu-cheng-fu
Lan-tsai-chiao
Wu-chang-ting
TOBACCO
OPIUM
HEMP
Shuang-shan-tse
MAIZE
Shan-hua-tsu
Tu-chiao-tsu
Fa-ta-ha-men
Hei-lin-tsa
Pai-chia-tun
Shih-li-ho
COAL
Lao-Pai-La-Tsu Mt.
Pass
Numerous distilleries
SMALL MILLET
INDIGO
Wang-chia-tun
Wu-la-kai
Mu-shih-hua
Yang-cheng-tse
San-chia-tsu
Ta-ka-chia-tsu
Shai-chan
Miaoling
Tu-tun
La-fa
Ta-ting-tsu Mt.
Swamp
District
Ninguta
Military Post
Sali-chion
Khun-chi-hu
Sha-ta-ken-sa
En-chian
Birtun
Sanker
Mukde-ken Range
Tumen-shan-tse
Tun-gu-lin
Ta-lin-khe
Mure-khe
Loe-lin
Sondau-khesa
Yu-shu-ka
Chan-chia-tsu
Hung-shih-la-tsui
Min-chia-tun
Wu-kuai-shu
Chung-ting-tsu
Hung-tu-la
Shiang-yang-pao
Kao-shan-tun
Ku-chia-tien
Yen-chia-tsui
Chang-ka-ti
Yu-tung-Ho
Yu-ma-Ho
Marsh
Wu-chia-tsan
Liu-ti-tun
Kuan-ti
Hung-tsan
Fort
Ni-chia-tien
Yen-chia-tien
Lan-ling-ho
Marsh
Bei-shin-cheng (Petuna)
Grass land
Kuan-ti
Liu-ti-tun
Wu-chia-tsan
Lake
Oster swamps


CENTRAL AND SOUTHERN
MANCHURIA
Compiled from R. T. Turley's observations, the latest Admiralty Charts & Russian Maps.
1899.
Scale of Miles
10 5 0 50 100
Natural Scale 1:2,000,000 or 1 Inch=31.6 miles.
Main Trade routes
Roads & Cart tracks
Telegraph lines
Railways open
Do. in course of construction
Shang-hai
Kiang
Kagoshima
120
130
140
44
43
42
41
Tsagan-khere
Tsunga-tume
Nosumo
Sira Muren
Huai-tai-hsien (Ta-pa-chia-tsu)
Cultivated by Chinese
Great white trade road
Chang-chia-tun (Mongol trade)
Villages of Mongol Chinese Serfs
Lui Ho
Feng-hua-hsien (Mai-mai-kai)
Tsiang-shen
Tsamien-cheng
Su-pingkai
Ta-wa
Yi-huo
Pass 500
Lao Khe
Shi-er-gudsa
Tsara Nor
Tsanak R.
GOLD
GOLD & COPPER
Dunga-shu
Khe-yai
Mal'u-ger
Er-shi-chia
Lo-fan-sin
Ta-yi-insa
Sand hills
Harrachin Mongols
Mongol Trades Palace
Kang-ping-hsien
Chang-tu-fu
San-yen
Kao-chias
Huang-hua-shan
Kai-yuan
Wu-yuan-fu
Old hunting forest
Low Sand hills
(Great Mongol barter trade Autumn Cattle Fair)
Kulang
Lama temple
Chuen-chan
Ta-miao
Grass plain
Imperial cattle reserve
She-shan-tsuo
Sandy waste
Tung-yü
Ha-lao-ta-hai (Felt skin trade)
Ta-kang-chuo
Hei-shui-lao
Teling
IRON
Liao-hai-tun
Fan-hao
COAL
Villages
Chinese Gold mining Co.
Shin-min-tun
Huang-shan
Shing-lung-ku
Pai-tu-chang-men
Pan-chia-kang
Pa-la-men
Pai-chu-fu
Liang-shang
HARD COAL
Chao-yang-hsien
Tamot
Hsia-hei-tsui
Kuang-ning
GRAPES
I-chan
Ta-ling Ho
Kortsin
Sung-ling-men
Sa-ku-tun
Chin-chen
LIME
COAL
Kao-hu
Liu-hu
Shih-tai-tun
Ku-erh-chan
Erh-o-tsu
Lien-shi
Li-shu-ka
Kan-tsai
Ta-li-chia-tun
Liang-tun
Shia-yü-chang
Shi-ta-men
Shuang-shan
Lao-tao-kai
Feng-chuan-yeng
Hsi Shan or West Ts.
Kao-chao
Port of Tien-cha-chang
Hulutan Prom.
Yang-yuan-chau
Tau-hwa
Saddle I.
Warren Pt
St Ubes Pt
Sand Point
Tsung-huo-soe
Shuang-tien
Hsiao-lung-hao
Shih-shan-chan
Chao-cha-tien
Pa-chia-tai
Pa-chia-chuang
Shu-sha-ling
Tien-cha-tai
Tien-chuan-tai
Ta-ling-ho
Tau-fun-cheng
Liao-yang
Liao-ho
Hun R.
Hun-ho-fu
Pau-ta-fu
Chang-shing
Chia-chia-tun
Shing-king
MUKDEN
Shing-ching
Fu-ling
Tombs
Fu-shan
Ta-chiao
Sha-ling
Chang-tang
Hsiao-shi-tun
Pan-cha-tai
Se-chuang
Hsiao-pei-hua
Sha-erh-fu
Sha-hua
Lao-erh-fu
850
Shu-shan
Sha-huo-tsu
Teng-ao-fu
Keng-chuang
Ang-ka-tsu
4000
Hai-cheng
Old Nui-chuang
Nui-chuang-tsu
Swampy
Port Niu-chuang
Salt pans
Swamp
Kai-chau
Hsiung-yao
Hsu-yen
Sand Point
Shih-nu-cheng
Lan-chi-tai
Kao-kan
Shan-shi-chiao
Lan-chu-chang
Pa-ti-fu
Ta-shih-chien
Pa-kuai-ku
Ta-tung-ling
Pass
Hsiao-jao-shan
Fen-shui-ling
Ta-men-ling
Yen-tai
Wen-chia-tai
Chao-hao-ka
Huo-chia-ka
Feng-huan-cheng
Mt Feng-huan
Ai-yang
MAIZE
SILK
Volcanic Area
Lien-shan-kuan
Mt Lao-Pa
3000
Ping-ting-shan
Chien-chang
Hot Springs
Chiu-bai-yu
Gorge
Khan-men-shan
Hsu-chiao-ling
Pass
Old crater
Lien-shan
Jauan
Ta-ma-chi
IRON WORKS
HARD COAL
Huan-ka Gorge
Mt Lao-Pa
3000
Kuan
Old crater
Ai Ho
Old fort
Ta-ling-ho
Tau-fun-cheng
Pa-chia-chuang
Old cross road
Ta-wop
Tien-chuan-tai
Ta-ling-ho
Liu-hu
Shih-tai-tun
Ku-erh-chan
Erh-o-tsu
Lien-shi
Li-shu-ka
Kan-tsai
Ta-li-chia-tun
Liang-tun
Shia-yü-chang
Shi-ta-men
Shuang-shan
Lao-tao-kai
Feng-chuan-yeng
Tsung-huo-soe
Warren Pt
St Ubes Pt
Sand Point
Tau-hwa
Saddle I.
Yang-yuan-chau
Port of Tien-cha-chang
Hulutan Prom.
Kao-chao
Ku-erh-chan
COAL
Erh-o-tsu
Lien-shi
Kan-tsai
Li-shu-ka
Liang-tun
Ta-li-chia-tun
Shia-yü-chang
Sho-huo-soe
Shi-ta-men
Shuang-shan
Lao-tao-kai
Feng-chuan-yeng
Hsi Shan or West Ts.
Liu-hu
Shih-tai-tun
Chin-chen
LIME
COAL
Kao-hu
Sung-ling-men
Sa-ku-tun
Ta-ling-ho
Kortsin
Chao-yang-hsien
Tamot
Hsia-hei-tsui
Liang-shang
HARD COAL
Shing-lung-ku
Pai-tu-chang-men


KIRIN
4000
Mt. Foskin
Lao-Pai-La-Tsu Mt.
Pass
Wu-la-kai
Ta-ting-tsu Mt.
Chang-chun-fu
Yi-ting-chu
Yeng-tung Shan
Hai-lung-cheng
Lo-tu-la-tsu
3000
Hua-tung-hsien
Huai-yen-hsien
Mt. Ko-chiel-yong
Mt. Ka-sal-yeng
Mt. Oma-yong
Mt. Kienfung
8100
Mt. Tao-kuang
6300
Mt. Cho-deun-sion
Mt. Kil-chu
Mt. Chan-dek
Sam-su
Paik-to-san
(Long White Mt.)
Paik-un-san
Paik-san
Mo-so-dun Range
Ke-shan Range
Nya-man-kada Mts
Chian-guan
Loe-lin
Mukde-ken Range
Kai-si-yin Mts
Ninguta
Military Post
Birtan
Sinker
Hun-chun
On-seng
Tumen R.
Keng-seng
Meng-cheng
Tan-cheng
Ko-si
Pallada Road
Plaksin B.
Yashina I.
Arefev I. 500
White Rocks 200
Numerous distilleries
SMALL MILLET
INDIGO
COAL
OPIUM
TOBACCO
OPIUM
HEMP
MAIZE
Swamp
District
Oyster swamps
Fertile plain
Pagoda
Marsh
Ferry
Fossiet Bay
Linden Pt.
Mojiski Pt.
Enkrista Pt.
C. Kolokoltzov
C. Urasov
C. Kosakov
C. Schlippenbach
C. Mon-pai-kot (C. Boltin)
Rodionov Pt.
Awacam I.
Hornular G.
Anna Bay
Saselovka
Tumen R.
Sisura Pt.
Belava Scala
Koshkevitch B.
Vlagoftitchenski Pt.
Arakot
Sen-chin
Sa-puk
Kun-sen
Sha-pon
Ko-si
Wa-chun Kot
Chan-sa-chu
Ke-san
Yu-wen
Kun-keng
Son-wen
Cha-sion
Pok-dun
Pak-don
Chan-tsu-lau
Kuan-phien
Chang-tien
(Old Fort)
Yang-tien
(Old Fort)
Ak-kam
Chosan
Ta-tsa-shan
Pass
Ping-shao
Pass
Yang-mu-lin-tsu
Wai-cha-ku-men
Ma-kai
Kang-kyei
Sin-kaan
In-cho-ko
So-oi
Ka-chin
Ch'n-pho
San-si-pun
Wi-wen
Ko-san-ni
Tang-tsu
Gorges
Rapids
Whirlpool
Gorge
Ko-ja-sen
Tung-ka
Tan-pho-djin
No-to
Sa-Sung-Ka
Chi-ku-la-tsu Mt.
Wu-nu-shan
IRON WORKS
ASBESTOS
COAL
Pai-la-tsu
3000
Ka-ka-ri-ka-Hao (Valley)
Chang-ming-shan
Wang-shing-men
Pass
2000
Chang-ka-ti
Hung-tu-ti
Shiang-yang-pao
Shan-hua-tsu
Ta-chiao-tsu
Fa-ta-ha-men
Hei-lin-tsu
Pai-chia-tun
Shih-li-ho
Wang-chia-tun
Mu-shih-hua
Yeng-cheng-tse
San-chia-tsu
Tu-ku-chia-tsu
Miaoling
La-fa
Tiu-tun
Shui-chan
I-che-sun-chian
San-cha-ho
Cha-la-hao
Shuan-yang-hua
San-chia-tsu
Tung-ling-pass
Ta-la-chan
Chang-ling
Heng-tao-ho
Kuan-kai
Kan-yang-tsu
Mu-tsun-Ho
Kuan-cheng-tsun
Pai-yen-chan
Hei-lin-tsu
Lu-chia-ho-yen
Hsiao-ka-shan
Kolo-shu
Huo-shih-ling
Ying-cheng-tsu
Tai-ping-chiao
Mt. Chao Yang
Teh-sheng-kai
Erh-Yao-hua
Tai-ping-shan
Yu-shih-ka-tsui
Chao-yang-chen
Liu-huo-chen
Pai-yen-hua
Na-ka-tsu-ka
Shan-tang-hao
Ko-shu-hua-tsu
Erh-tao-Hua
Chien-chang-kao
Ta-chien-ka
Lo-Cheng-tsu
Lao-ling
Wang-shing-men



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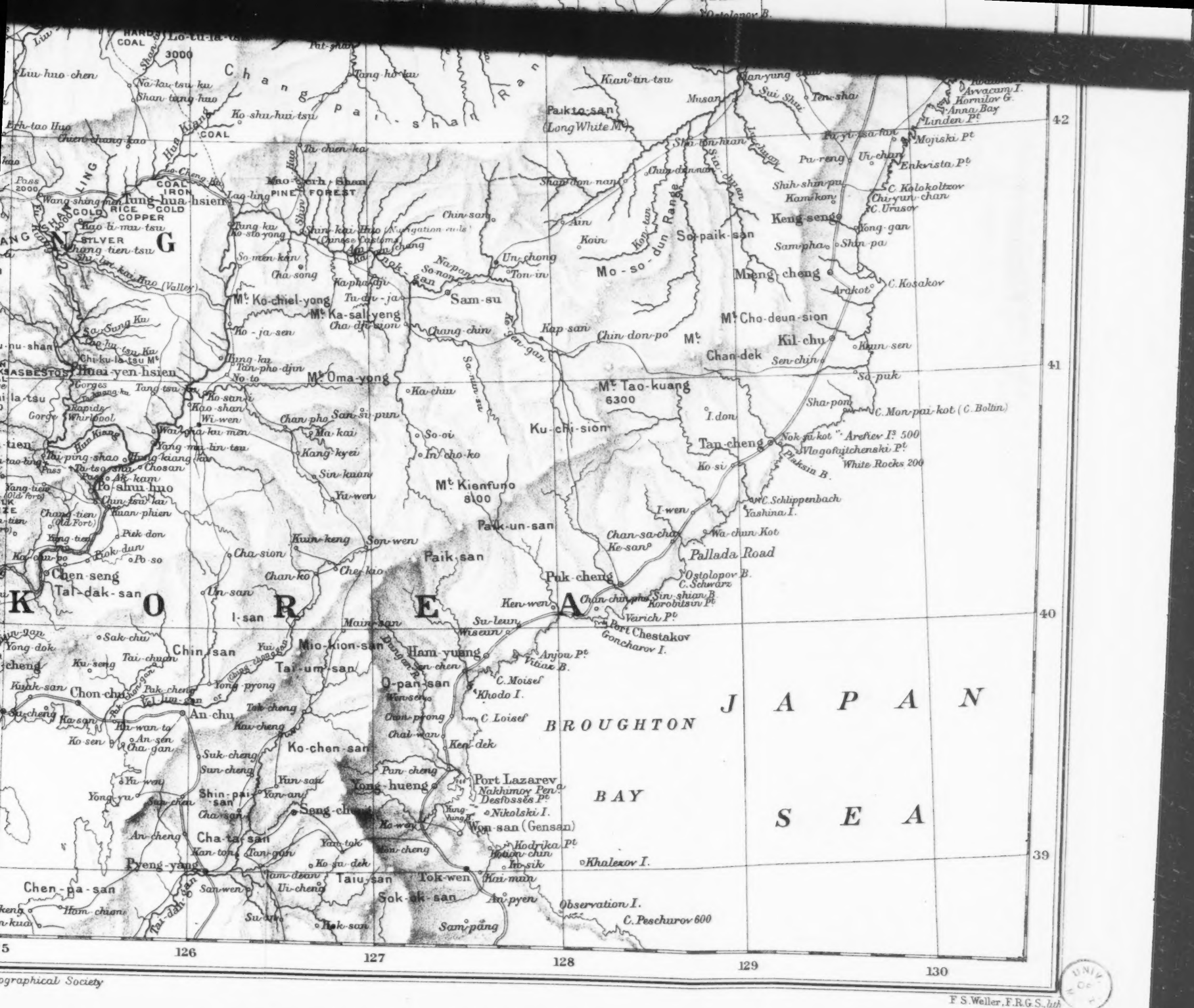
Paik-to-san
(Long White M.)
Mt. Ko-chiel-yong
Mt. Ka-sal-yeng
Mt. Oma-yong
Mt. Tao-kuang
6300
Mt. Kienfuno
8100
Mt. Cho-deun-sion
Sam-su
Mo-so-dun Range
So-paik-san
Mong-cheng
Kil-chu
Chan-dek
Ku-chi-sion
Tan-cheng
Pallada Road
Paik-un-san
Paik-san
Pak-cheng
Ham-yung
Mio-kion-san
Tai-um-san
O-pan-san
Chin-san
An-chu
Ko-chen-san
Port Lazarev
Nakhimov Pen.
Desfosses Pt.
Song-chin
Won-san (Gensan)
Cha-ta-san
Pyeng-yang
Taiu-san
Tok-wen
Sok-ok-san
Chen-pa-san
Chen-seng
Tal-dak-san
I-san
Kai-mun
Ko-sen
Ko-shu-huo
Huei-yen-hsien
Lung-hua-hsien
Mao-erh-Shan
PINE FOREST
Paik-san
Chang-pai-shan Range
Ham-yung Range
Sui-Shui
Musan
Kian-tin-tsu
Ta-chen-ko
Tang-ho-ku
Ko-shu-hui-tsu
Na-ka-tsu-ku
Shan-tang-huo
Liu-huo-chen
Hua-Kiang
Yalu
Tumen
Sea of Japan
JAPAN
SEA
BROUGHTON BAY
Observation I.
C. Peschurov 600
Khalexov I.
Khodrika Pt.
Nikolski I.
C. Loisel
C. Moisef
Khodo I.
Anjou Pt.
Vitiaz B.
Port Chestakov
Goncharov I.
Varich Pt.
Korobitsin Pt.
Sin-shian B.
C. Schwarz
Ostolopov B.
Wa-chun Kot
C. Schlippenbach
Yashina I.
Paksin B.
Vlogofujtchenski Pt.
Nok-su kot
Areiev I. 500
White Rocks 200
C. Mon-pai-kot (C. Boltin)
Sha-pon
I. don
Ko-si
Sen-chin
So-puk
Kun-sen
Shin-pa
Yong-gan
Keng-seng
C. Kosakov
Arakot
C. Kolokoltzov
C. Urusov
Enkrista Pt.
Mojiski Pt.
Linden Pt.
Avvacum I.
Kormilov G.
Anna Bay
Ten-sha
Kian-yung
Ko-shu-huo
Ko-sen
Ham-yung
Ham-chang
Ham-dok
Ham-heung
Yong-hueng
Yong-yu
Yong-dok
Yong-prong
Yong-tong
Yong-an
Yong-chang
Yong-chon
Yong-ju
Yong-ko
Yong-ni
Yong-san
Yong-sen
Yong-tok
Yong-ung
Yong-wen
Yong-yen
Yong-yu
Yong-chon
Yong-dok
Yong-heung
Yong-hueng

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Ke-shan Range
Chang pai-shan
Mo-so-dun Range
Mo-so
Mt. Ko-chiel-yong
Mt. Ka-sal-yong
Mt. Oma-yong
Mt. Tao-kuang
6300
Mt. Kienfung
8100
Sam-su
Ku-chi-sion
Pallada Road
Port Lazarev
Nakhimov Pen.
Won-san (Gensan)
Broughton Bay
Japan Sea
Observation I.
C. Peschurov 600
Khalexov I.
Port Chestakov
Goncharov I.
Rodionov Pt.
Linden Pt.
Mojiski Pt.
Erkrista Pt.
C. Kolokoltzov
C. Kosakov
Arajkot
Tan-cheng
Ko-si
Yashina I.
C. Schlippenbach
White Rocks 200
C. Mon-pai-kot (C. Boltin)
Sha-pon
Sa-puk
Kal-chu
Mun-sen
Ser-chiu
Chang-chun
Chin-don-po
Mang-chong
Shin-pa
Kong-gan
Kan-pyong
Yong-hung
Ham-yung
Pak-cheng
Chin-chu
Su-ryun
Kan-wen
Ko-chen-san
Taiu-san
Sok-to-san
Long White Mt.
Lo-tu-la-tai
3000
HARD COAL
COAL
IRON
GOLD
COPPER
SILVER
PINE FOREST
Tumen R.
Tumen
Kao-lin
Chong-sang
Hun-chun
Ou-song
Yang
Tung-hung
Musan
Kum-un-tsu
Pan-san
Sui-shin
Ten-shin
Kan-yung
Kai-shui
Ryan-chi
Pa-tsui
Ui-chon
Shin-kai-ho
Ko-sto-yong
Un-chong
Ton-in
Kain
Kain
Sam-shin
Kang-dong
Kang-gan
Kan-tan
Kan-tan
Kan-t